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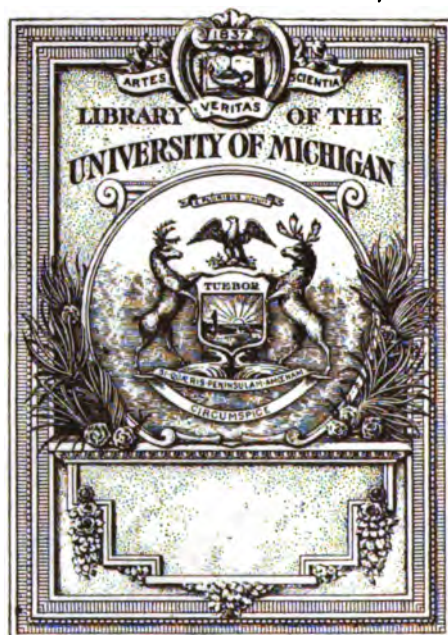
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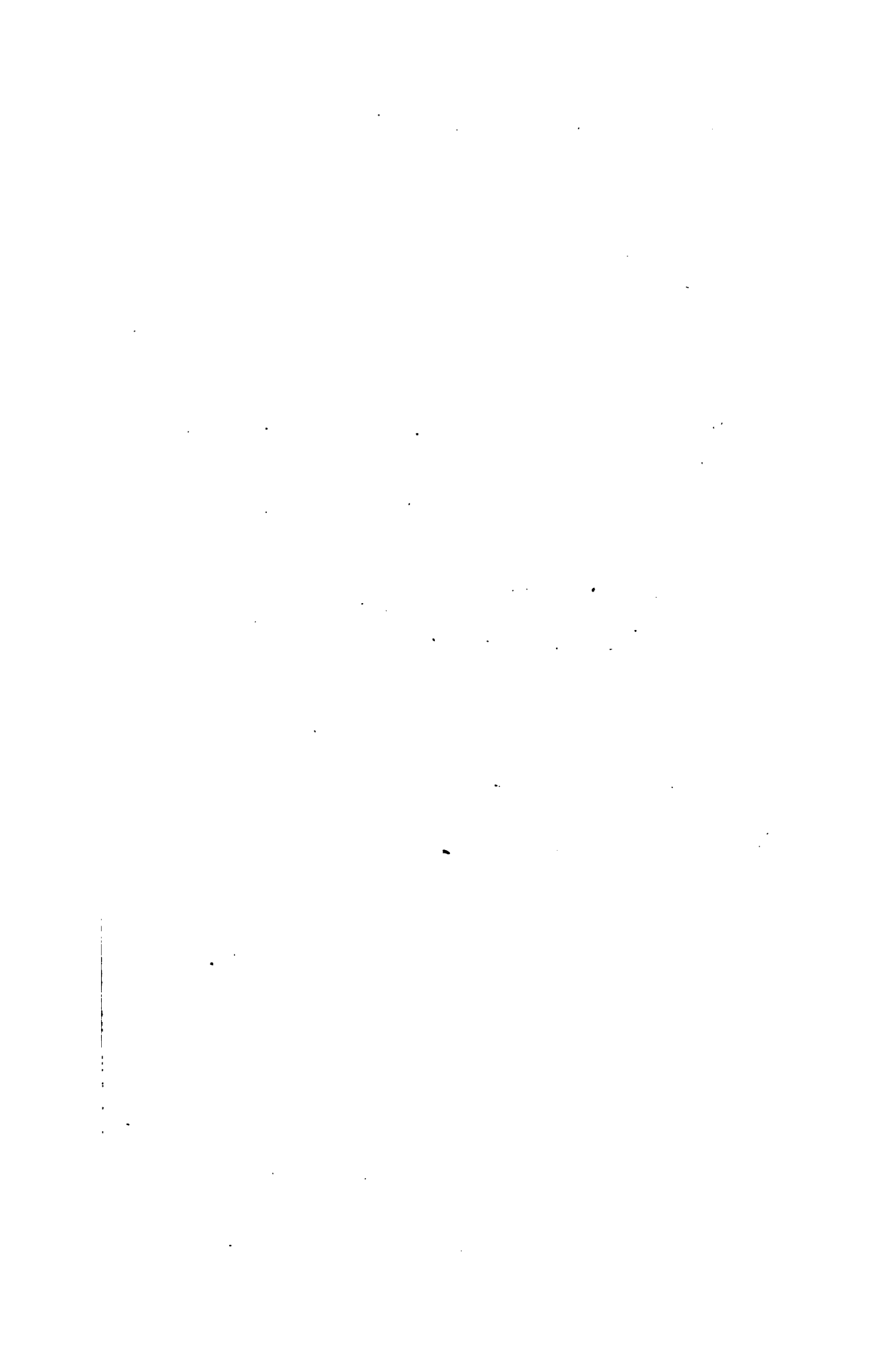
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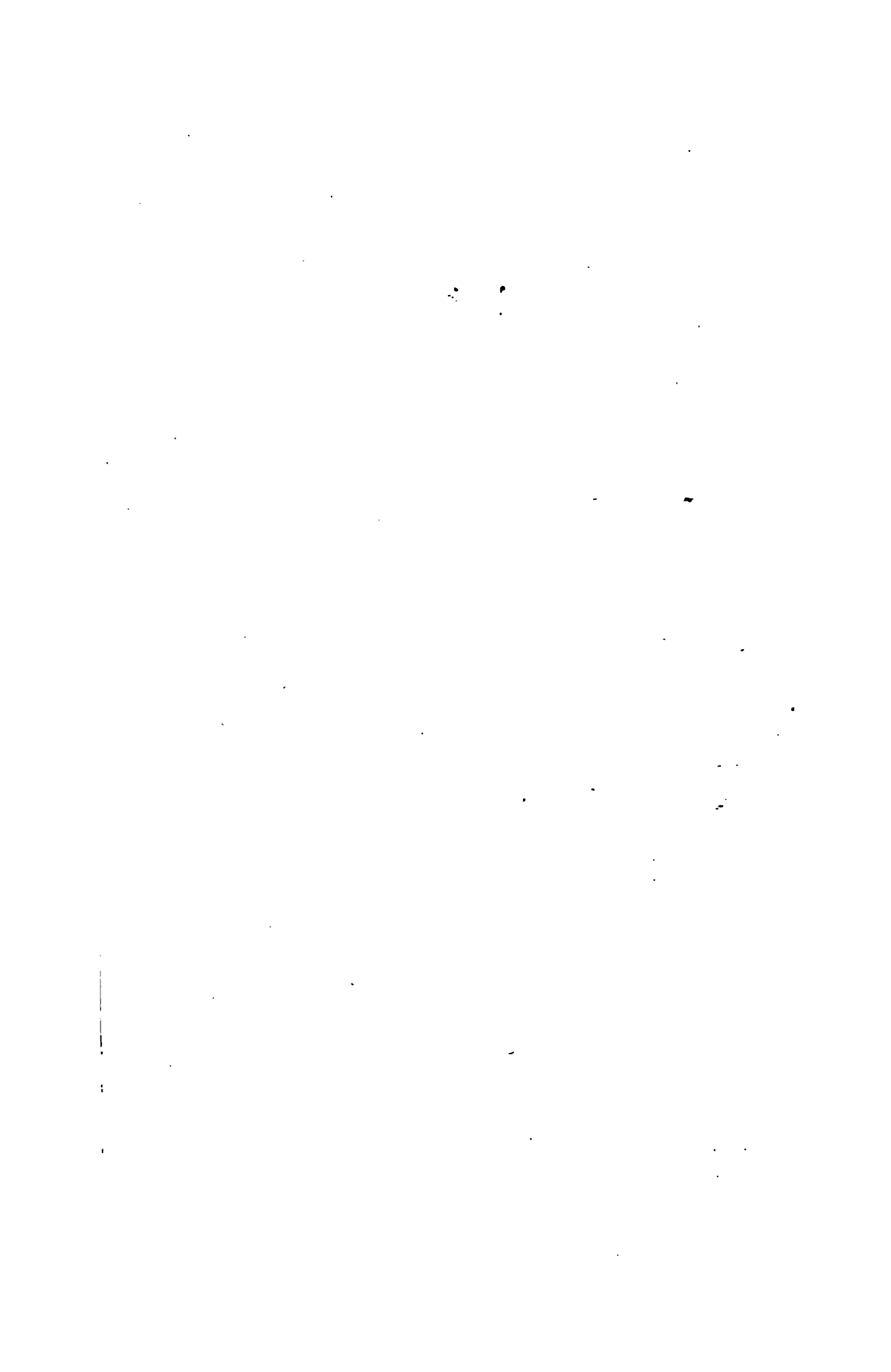
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A MANUAL  
OF  
MATERIA MEDICA  
AND  
PHARMACOLOGY.

COMPRISING ALL

ORGANIC AND INORGANIC DRUGS WHICH ARE OR HAVE BEEN  
OFFICIAL IN THE UNITED STATES PHARMACOPŒIA,

TOGETHER WITH

IMPORTANT ALLIED SPECIES AND USEFUL SYNTHETICS,  
ESPECIALLY DESIGNED FOR STUDENTS OF PHARMACY AND MEDICINE, AS WELL AS  
FOR DRUGGISTS, PHARMACISTS, AND PHYSICIANS.

BY

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MARYLAND DENTAL, MEDICAL, AND PHARMACEUTICAL SCHOOLS.

*FOURTH EDITION, ENLARGED AND THOROUGHLY REVISED.*

WITH FOUR HUNDRED AND EIGHTY-SEVEN ILLUSTRATIONS.



LEA BROTHERS & CO.,  
PHILADELPHIA AND NEW YORK.

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## PREFACE TO THE FOURTH EDITION.

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SINCE the appearance of this work, nine years ago, three editions have been exhausted, the last now being out of print some months. The author, accepting this approval as indicating a reasonable fulfillment of a cherished ambition—that each edition be an improvement on its predecessor—has been stimulated, in preparing the present revision, to expend unusual care and time that it might accurately reflect the latest knowledge in its domain, and thereby be strengthened in scientific value and more fully merit the favor of teachers and practitioners of pharmacy and medicine.

In order that this might be accomplished, some delay has been unavoidable, partly from the deliberation exercised in issuing the Eighth Decennial Revision of the U. S. Pharmacopœia, but mainly from the great labor necessary in arranging the matter in conformity with that standard. In view of the purchased privilege to use that text, there has been no reserve in following it, as parallel similarity is an advantage to the student. No attempt, however, has been made to accept its doses, for reasons scarcely needing comment, when such similarly acting drugs as *anthemis* and *matricaria*, for example, have had assigned to them by the Revision Committee the respective varying quantities: 2 Gm. (30 grains) and 16 Gm. (240 grains).

It is scarcely too much to say that the volume now in the reader's hands approaches more nearly to a new work than to its former self, inasmuch as almost every subject has either been rewritten or distinctly modified.

A number of new illustrations have been introduced to replace or supplement many older ones, in the hope of aiding visual instruction. Of such the following deserve mention: *belladonna*, *cinchona*, *caffeä*, *digitalis*, *eucalyptus*, *gambir*, *gossypium*, *hyoscyamus*, *pilocarpus*, *quillaja*, *taraxacum*, *thymus*, *uva-ursi*, *veratrum*, *verbascum*, etc.

The arrangement of the drugs remains strictly the same as that followed in previous editions, being based upon the principle of *associating as nearly together as possible those substances, organic and inor-*

ganic, which have a common or allied origin, allowing those next related to follow in regular order, the basal or parental source thus being kept paramount. Vegetable drugs, therefore, appear in the order of natural historic relationship of the plants from which obtained—i. e., botanic sequence, beginning with the more simple and gradually approaching those more complex. That this might be possible and in accord with Nature's process of evolution, the classification of Engler and Prantl, as enunciated in their *Die Natürlichen Pflanzenfamilien*, has been followed, modified, however, occasionally in accordance with Engler's *Syllabus der Pflanzenfamilien*, and also Britton and Brown's *Illustrated Flora*. Animal drugs also are treated so as to be in harmony with this great natural law of development of the animals from which obtained—i. e., zoölogic sequence, beginning with the lower and proceeding always to those of higher organization. Organic drugs, carbon and synthetic compounds are arranged similarly, their chemical relationship, however, being borne always in mind. Measurements are expressed in the metric system, followed by approximate equivalents in the English, and temperature is stated in both Centigrade and Fahrenheit scales, thereby giving an equal opportunity for use according to individual preference. Doses are stated in the apothecaries' and metric system, in the hope that the easy comparison of the parallel equivalents may afford a stronger mental impression, and thereby become an element toward metric education.

The accent of generic and specific names continues to be placed on the final letter, consonant or vowel, of the accented syllable (not simply upon the vowel of that syllable)—certainly the most rational method, and one by which it is believed the student will obtain more readily an intelligent idea of pronunciation. Several pages will be found devoted to the pronunciation of words more or less troublesome to the average student, the aim having been to follow the best philologists rather than general usage.

To those who, in their teaching, have used the work, thereby aiding its dissemination, and to those who in any way have contributed assistance by word or deed, the author extends his grateful acknowledgment. Especially is he indebted to his tried and faithful colleague, Prof. Caspari, and valued friend, Prof. Rusby, for access to advanced sheets of the *National Standard Dispensatory*, from which much helpful information was obtained.

DAVID M. R. CULBRETH.

BALTIMORE, 1906.



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## ABBREVIATIONS USED THROUGHOUT THIS WORK.

The degree sign ( $^{\circ}$ ) associated with numerals indicates *feet*, except when accompanied with the capital letters C. and F., then it represents *degrees* (temperature); the prime sign ( $'$ ) attached to figures is used for *inches*, but when following italic vowels denotes the *accented syllable*.

Ar., Arabic.	F., Fahrenheit.	P. c., p. c., Per cent(um).
Br., British.	Mt., Mount, mountain.	Cc., Cubic centimetre.
Br. P., British Pharmacopœia.	Adj., adj., Adjective.	L., Litre.
Cod., Codex, French Pharmacopœia.	Dim., dim., Diminutive.	Ml., Millilitre.
Eng., English.	Contr., contr., Contraction.	M., Metre.
Fr., French.	Prep(s), Preparation(s).	Mm., Millimetre.
Ger., German.	P. p., pp., Past participle.	Cm., Centimetre.
Ger. P. or Ger. Phar., German Pharmacopœia.	Unoff., Unofficial.	Gm., Gramme.
Gr., Greek.	Syn., Synonym.	Kg., Kilogramme.
Heb., Hebrew.	Fr., fr., From.	Km., Kilometre.
Hind., Hindoo.	Tr., Tinct., Tincture.	M., min., Minim.
OE., Old English.	Dil., dil., Dilute(d).	Gr., gr., Grain.
Per., Pers., Persian.	Alc., alc., Alcohol.	lb., Pound.
Peruv., Peruvian.	T. S., Test Solution.	ʒ, Drachm (solid or fluid).
Portg., Pg., Portuguese.	V. S., Volumetric Solution.	ʒ, Ounce (solid or fluid).
Skr., Skt., Sanskrit.	$\frac{N}{10}$ , Decinormal.	ʒ, Scruple.
Sp., Spanish.	Sp. gr., Specific gravity.	ss, Half.
C., Centigrade.	U. S. P., United States Pharmacopœia.	+ (plus), — (minus).
	Q. S., q. s., Sufficient quantity.	× (multiplication).
		= (equals), □ (square).

## THE GREEK ALPHABET.

Α α a . . . . . Alpha.	Ν ν n . . . . . Nu.
Β β b . . . . . Bêta.	Ξ ξ x . . . . . Xi.
Γ γ g . . . . . Gamma.	Ο ο o short . . . Omicron.
Δ δ d . . . . . Delta.	Π π p . . . . . Pi.
Ε ε e short . . . Epsilon.	Ρ ρ r . . . . . Rho.
Ζ ζ z . . . . . Zêta	Σ σ ς s . . . . . Sigma.
Η η e long . . . Eta.	Τ τ t . . . . . Tau.
Θ θ θ th . . . . . Thêta.	Υ υ u . . . . . Upsilon.
Ι ι i . . . . . Iota.	Φ φ ph . . . . . Phi.
Κ κ k . . . . . Kappa.	Χ χ ch . . . . . Chi.
Λ λ l . . . . . Lambda.	Ψ ψ ps . . . . . Psi.
Μ μ m . . . . . Mu.	Ω ω o long . . . Omêga.



## MATERIA MEDICA AND PHARMACOLOGY.

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DISEASE seems to have been man's natural inheritance, while curative methods and remedies are largely his adaptation and creation. From early biblical times the ills "that flesh is heir to" were recognized as a deadly menace to the human family, and whether the vain appeal was made, then or since, to either (for each in turn enjoyed a period of favor) fetishism, sorcery, religious incantations, faith, Christian science, astrology, magic-art, enchantment, witchcraft, spells, charms, hydropathy, venesection, or drugs, the same inherent hope and purpose has ever prevailed—to relieve and palliate physical suffering. Human thought, happily, is no longer so speculative and superstitious, consequently universal intelligence has allowed medical appliances and treatment to be shaped into a systematic and veritable science.

MATERIA MEDICA (L. medical material) is a treatise upon the materials, agents, or appliances used in medicine—including their name, source or origin, habitat, family or natural order (organic), physical characteristics, methods by which obtained, tests for purity and adulterations, constituents or composition, forms of administration (preparations), physiological action or properties, uses or therapeutics (therapy), normal and lethal doses, antagonists, incompatibilities, synergists (organic and inorganic), and other important features.

PHARMACOLOGY (Gr. *φάρμακον*, a drug, medicine, + *λόγος*, discourse) is a similar but more modern term, implying the sum of scientific knowledge of drugs, which is taken to include their art of preparation—pharmacy, and all that is known of their action—pharmacodynamics, being at present usually restricted to this latter meaning. The subject in its entirety is so broad and comprehensive that subdivisions have been made, and to some of these distinctive names are given.

1. *Pharmacy* (Gr. *φαρμακεία*, the use of drugs): comprising the art of preparing drugs in suitable forms for dispensation, administration, or application, and includes an acquaintance with much of materia medica, practical and theoretical chemistry, and many manipulations peculiar to itself.

2. *Pharmacognosy* (Gr. *φάρμακον*, a drug, + *γνώσις*, knowledge): comprising the study of physical and chemical characters of drugs—the knowledge of selecting, recognizing, and identifying true and false specimens by such characteristics.

3. *Pharmacodynamics* (Gr. *φάρμακον*, a drug, + *δύναμις*, power): comprising the knowledge of physiological action—power or strength

of remedial agents on living organisms of man or lower animals during health.

4. *Toxicology* (Gr. τοξικόν, poison, + λόγος, discourse): comprising the effect, nature, and detection of drugs when given in poisonous doses—the treatment and antidotes for same.

5. *Therapeutics* (Gr. θεραπεύειν, to cure): comprising the intelligent application or use of agents to cure disease—how they act on living organisms during sickness: (a) *rational*, when based upon known laws of the remedies and diseases, as gained through pathology, physiology, and pharmacodynamics, thereby giving the only scientific treatment; (b) *empirical*, when based solely upon clinical observation and experience—the employment of a remedy in any pronounced disease, from its valuable service in previous similar cases; (c) *general*, where other than drugs or medicines are used for curative purposes: 1. Hygienic agents—cleanliness, pure air, ventilation, proper food and clothing, rest, etc.; 2. Mechanical agents (semi-surgical)—bleeding, leeches, cups, scarifications, issues, setons, frictions, massage, aspiration, acupuncture, gastric lavage, stomach-pump, sprays, syringes, catheters, bed-pans, urinals, hot-water bags, trusses, pessaries, suspensories, bandages, rubber stockings, jackets, thermometers, etc.; 3. Physical agents—*Heat*: solar, artificial (dry or moist vapor), baths—tepid, 29–35° C. (85–95° F.), warm, 35–38° C. (95–100° F.), hot, 38–41° C. (100–106° F.), Turkish, 35–71° C. (95–160° F.), hip or sitz, hot wet-pack; *Cold*: plunge or shower bath, 4–15° C. (40–60° F.), cold wet-pack, rubbing wet-pack, 4–21° C. (40–70° F.), sponging, ice-bag, compresses, douches; *Light*: although at times contraindicated, acts usually as a stimulant or tonic to the blood—correcting imperfect nutrition and imparting strength to organs; *Darkness*: on the other hand, acting as a sedative or tranquillizing agent; *Air*: pure, impure, compressed, hot, 93–149–204° C. (100–300–400° F.); *Electricity*: continuous (galvanic) and induced (faradic) currents, static (frictional) by electric bath, spark, Leyden-jar shock, brush.

Upon the general subject of materia medica, and each of these subdivisions, there are very many published works, but only pharmacy has what may be termed a standard code for reference.

The *Pharmacopœia*, U. S. P. (Gr. φάρμακον, a drug, + ποιῆν, to make), is such a standard for us, and other countries each have, in a measure, their own. In this volume are enumerated the most important and reliable drugs with their preparations, which list is, however, more or less changed, in conformity with scientific progress, at each decennial edition.

The *Dispensatories*, several in number, are reference-works—in fact, materia medicas of the most liberal form, treating not only of the five departments as previously defined, but exhaustively of all other phases of the various sciences bearing upon each drug, official or non-official. Owing to their scope and reliability, they are regarded by the pharmaceutic profession with scarcely less favor and authority than the *Pharmacopœia*.

## FORMS IN WHICH MEDICINES MAY BE USED.

In early times the crude drugs usually were administered, but some being insoluble, nauseous, irritating, bulky, and ill-suited for either internal or external application, led to the adoption of other forms, such as decoctions, infusions, juices, powders, pills, ointments, etc. At the present day elegant pharmacy has placed us in possession of additional and still more acceptable forms and shapes, the most important being here enumerated.

1. OFFICIAL (liquids, semi-solids, and solids).

1. *Acetum*, *Aceta* (vinegars).—10 p. c. Macerate with diluted acetic acid, filter : *Opii*, *Scillæ*.

2. *Aqua*, *Aquæ* (waters).—Distilled water impregnated with a volatile substance, by (*a*) *trituration* : *Anisi*, *Menthæ Viridis*; (*b*) *solution* : *Amygdalæ Amaræ*, *Rosæ*; (*c*) *aëration* : *Ammoniæ*, *Ammoniæ Fortior*; (*d*) *distillation* : *Aurantii Florum Fortior*, *Rosæ Fortior*.

3. *Cataplasma*, *Cataplasmata* (cataplasms, poultices, Gr. *καταπλάσσειν*, to spread over).—Soft pasty masses to supply moisture and warmth locally in order to break down inflamed tissues; flaxseed meal, slippery elm, hops, bread and milk, kaolin and glycerin, bran, oatmeal, etc., answer well for these, to which either tincture of opium, aconite, arnica, or anodyne alkaloid may be added to lessen pain. The true poultice should be made by bringing the moistened mass to a boil, enclosing same in a cheese-cloth bag, and applying one-half to one inch thick over inflamed area; the addition of a little fixed oil or glycerin serves to retain heat and prevent caking, while a covering of oiled silk causes these properties to be retained much longer : *Kaolini*.

4. *Ceratum*, *Cerata* (cerates, L. *cera*, wax).—Unctuous-like ointments, but made firmer by the addition of wax; soften but do not melt at body-temperature; liquefy only above 40° C. (104° F.): *Camphoræ*, *Resinæ Compositum*.

5. *Charta*, *Chartæ* (papers).—Papers coated or saturated with some medicinal substance, to be used as a plaster or for burning : *Sinapis*.

6. *Collodium*, *Collodia* (collodions).—Collodion impregnated with medicinal substances for protection and medical effect : *Cantharidatum*, *Stypticum*.

7. *Confectio*, *Confectiones* (confections, boluses, L. *conficere*, to put together).—Pasty masses of drugs triturated with sugar or honey : *Rosæ*, *Sennæ*.

8. *Decoctum*, *Decocta* (decoctions, L. *decoquere*, to boil down).—5 p. c. aqueous solutions of vegetable drugs made by boiling the substance about 15 minutes in a closely covered vessel, and allowing to cool therein, then straining.

9. *Elizir*, *Elizira* (elixirs, Ar. *el-ik'sir*, the philosopher's stone).—Sweet, aromatic, hydro-alcoholic, medicated liquids; alcoholic strength 20–25 p. c. : *Adjuvans* (for flavoring), *Ferri*, *Quininæ et Strychninæ Phosphatum*.

10. *Emplastrum*, *Emplastra* (plasters, Gr. *εμπλάσσειν*, to daub on).—

Substances fused in such proportions as to adhere at body-temperature ; some are spread, others are not : Adhæsivum, Saponis.

11. *Emulum, Emulsa* (emulsions, L. *emulgere*, to milk out).—Aqueous, milky-like mixtures of oils, fats, or resins in a minutely subdivided state, suspended by mucilaginous materials ; coagulated by acids, metallic salts, or spirituous liquids in large quantities : Amygdalæ, Olei Terebinthinæ.

12. *Extractum, Extracta* (extracts, L. *ex*, out, + *trahere*, to draw).—Solid or semi-solid, made by evaporating medicinal solutions, or expressed juices of organic drugs, until representing 4 or 5 times the strength of the crude substance ; these may be aqueous, alcoholic, hydro-alcoholic, acetous : Aloes, Taraxaci.

13. *Fluidextractum, Fluidextracta* (fluidextracts).—Solutions of organic drugs evaporated until 1 Cc. represents the activity of 1 Gm. of crude drug : Aconiti, Zingiberis.

14. *Glyceritum, Glycerita* (glycerites, Gr. *γλυκύς*, sweet).—Solutions of a drug in glycerin for external use : Acidi Tannici, Phenolis.

15. *Infusum, Infusa* (infusions, L. *infundere*, a watering).—5 p. c. aqueous solutions of vegetable drugs, made by adding to the substance usually boiling water in a closely covered vessel and allowing to cool therein, then straining ; some are made by cold percolation : Digitalis, Sennæ Compositum.

16. *Linimentum, Linimenta* (liniments, L. *linere*, to smear).—Medicinal liquids, containing usually a fixed or volatile oil, for external use by rubbing or by simple application : Ammoniae, Terebinthinæ.

17. *Liquors, Liquores* (liquors, L. *liquor, liquere*, fluid, liquid).—Mostly aqueous solutions of non-volatile chemical substances : Acidi Arsenosi, Zinci Chloridi.

18. *Massa, Massæ* (masses, Gr. *μάσσειν*, to knead).—Pill-masses preserved in bulk to be used from when required : Ferri Carbonatis, Hydrargyri.

19. *Mel, Mella, Mellita* (honeys, Gr. *μέλι*, honey).—Medicines mixed with clarified honey instead of syrup : Depuratum, Rosæ.

20. *Mistura, Misturæ* (mixtures, L. *miscere*, to mix).—Liquids of insoluble medicines suspended in water by some viscid substance, or solutions of one or more active liquids : Cretæ, Rhei et Sodæ.

21. *Mucilago, Mucilagineæ* (mucilages, L. *mucere*, to be mouldy, slimy).—Saturated aqueous adhesive liquids of gum or starch : Acaciæ, Ulmi.

22. *Oleatum, Oleata* (oleates, L. *olea*, Gr. *ἐλαία*, olive tree, oil).—Solutions of medicines (alkaloids or metallic salts) in oleic acid : Atropinæ, Veratrinæ.

23. *Oleoresina, Oleoresinæ* (oleoresins, L. *oleum*, oil, + *resina*, resin).—Natural solutions of resin in volatile oils, extracted by ether, acetone, or alcohol : Aspidii, Zingiberis.

24. *Oleum, Olea* (oils, L. *oleum*, Gr. *ἐλαίω*, oil).—Liquid active constituents, obtained by (a) *distillation* : Æthereum, Thymi ; (b) *expression* : Adipis, Tiglii.



25. *Pilula, Pilulæ* (pills, L. *pilula*, a little ball, dim. of *pila*, a ball. Eng. abbr., *pil.*, pl. *pill*).—Spherical or oval masses of medicine held together by some adhesive substance : Aloes, Rhei Compositæ.

26. *Pulvis, Pulveres* (powders, L. *pulverare*, to powder).—Finely powdered drug or drugs, with or without a diluent, as milk-sugar : Acetanilidi Compositus, Rhei Compositus.

27. *Resina, Resinæ* (resins, L. ; Gr. *ρητίνη*, resin (of the pine)).—Resinous powders obtained by exhausting the vegetable drug with alcohol, and precipitating the tincture by adding water ; they contain all the principles soluble in alcohol and insoluble in water : Jalapæ, Scammonii.

28. *Spiritus, Spiritus* (spirit, spirits, L. *spirare*, to breathe, exhale).—Alcoholic or hydro-alcoholic solutions of volatile medicinal substances (chiefly volatile oils) : *Ætheris*, *Menthæ Viridis*.

29. *Suppositorium, Suppositoria* (suppositories, L. *supponere*, to place underneath).—Solids of suitable form containing medicines, which melt when inserted into the rectum, nares, urethra, or vagina, the vehicles being oil of theobroma, glycerinated gelatin, sodium stearate : Glycerini.

30. *Syrupus, Syrupi* (syrups, Ar. *shurab*, a drink, beverage).—Concentrated solutions of sugar, the menstruum being an aqueous solution of either medicinal or flavoring agents (simple syrup menstr. plain water) : *Acaciæ*, *Zingiberis*.

31. *Tinctura, Tincturæ* (tinctures, L. *tingere*, to dye).—Alcoholic or hydro-alcoholic solutions of non-volatile (except iodine) drug-constituents : *Aconiti*, *Zingiberis*. *Tincturæ Herbarum Recentium*, 50 p. c. ; prepared by macerating herb 50 Gm. with alcohol 100 Cc., in a closed vessel, moderately warm place, for 14 days, occasionally stirring, strongly expressing, filtering.

32. *Trituratio, Triturationes* (triturations, L. *triturare*, triturated).—Fine powders of medicinal substances 10 p. c., triturated with sugar of milk 90 p. c. : *Elaterini*.

33. *Trochiscus, Trochisci* (troches, Gr. *τροχίσκος*, a pill, troche).—Solid, round, oval, or flat masses of one or more medicinal agents, with sugar or extract of licorice, or both, caused to adhere by mucilage : *Acidi Tannici*, *Sodii Bicarbonatis*.

34. *Unguentum, Unguenta* (ointments, L. *unguere*, to smear, anoint).—Soft or solid fatty preparations, for external use, liquefying when rubbed upon the skin, and containing medicine in a basis of lard, benzoinated lard, olive, almond, or lard oil, prepared suet, wax, spermaceti, or paraffin : *Acidi Borici*, *Zinci Stearatis*.

35. *Vinum, Vina* (wines, L. *vinum*, wine).—Liquids differing from tinctures in being extracted with white wine, or a mixture of white wine and alcohol (20–25 p. c.) : *Antimonii*, *Opii*.

## II. NON-OFFICIAL.

1. *Abstracts, Abstracta*.—Powders having twice the strength of the vegetable substance, made by exhausting crude drugs, as a rule, with alcohol, recovering same, and incorporating residue with milk-sugar.

2. *Acetic Fluidextracts, Fluidextracta Acetica*.—Solutions of the active constituents of organic drugs made with diluted acetic acid, and of the same strength as the official fluidextracts.

3. *Bougies, Pencils*.—Small solid cylinders of gelatin, glyco-gelatin mass (white gelatin 3, glycerin 1), or cacao-butter, impregnated with medicine, to be inserted into urethra, vagina, rectum, or nares.

4. *Cachets (de pain), Konseals, Wafers*.—Various-sized concave wafers made of unleavened bread (flour and water), or wafer-paper—the cavity formed by moistening the concave edges of two and pressing together is to contain the drug; when fastened, take by floating them in a gulp of water.

5. *Capsules, Capsulæ*.—Various-sized, transparent casings (short tubes, usually with one open end fitting over that of another), of gelatin, hard or soft, for administering nauseous or disagreeable liquids or solids.

6. *Cigarettes*.—Have paper wrapper but filler of one or more medicinal substances—cubeb, stramonium, etc.

7. *Collyrium, Collyria, Eye-washes*.—Liquid applications for the eyes, composed usually of some astringent salt dissolved in rose water.

8. *Enemas, Enemata, Clysters*.—Liquids to be injected into the rectum. When large quantity (5xvj–32; .5–1 L.), it is to act mechanically in emptying the bowel, and warm soapy or mucilaginous water answers the purpose; when small quantity (5ij–4; 60–120 Cc.), it is to act as a medicine or nutrient, and after injection a towel pressed against the anus tends to aid retention, therefore absorption.

9. *Essences, Essentiæ*.—Liquids like our spirits (a name which they yet sometimes receive), 10 p. c., but in England 20 p. c.

10. *Fomentations, Fomenta*.—Flannels wrung out of hot water and applied with or without medication.

11. *Gargles, Gargarismata*.—Aqueous medicinal liquids for gargling the throat.

12. *Gauzes, Carbasi*.—Gauze-muslin saturated with a medicated solution of a definite strength, and then spread horizontally to dry.

13. *Hypodermic Injections, Injectiones Hypodermicæ*.—Usually aqueous solutions of vegetable drugs or alkaloids, 1–5–10–33 p. c.; sometimes a very small amount of either phenol (carbolic acid), benzoic, hydrochloric, or salicylic acid is added as a preservative.

14. *Inhalations, Inhalationes, Vapors, Vapores*.—Volatile liquid vapors breathed at ordinary inhalation, to act locally upon the respiratory mucous membrane.

15. *Injections, Injectiones*.—Usually aqueous solutions of drugs to be injected by a syringe into the rectum (enemas), under the skin (hypodermic), or into the urethral, nasal, aural, or vaginal tract.

16. *Insufflations, Insufflationes*.—Fine powders of active medicine, and mostly bland bases, to be blown into nares, larynx, throat, etc.

17. *Lotions, Lotiones*.—Mostly weak, aqueous medicinal solutions, to be applied locally on linen, lint, or muslin.

18. *Lozenges, Tablets, Tabellæ*.—Same as troches, being small flat-

tened cakes of medicinal substances, with sugar, an adherent and usually some flavoring material; in England restricted to those having as a basis chocolate, and of definite weight.

19. *Oxymella, Oxymellita*.—Liquid composed of honey 80 parts, acetic acid 10, water 10; used to incorporate nauseous medicines.

20. *Parvules, Granules, Dosi-metric Parvules*.—Very small pills, usually sugar-coated and containing poisonous alkaloids or chemicals.

21. *Paste*.—Name applied to any and all ointments.

22. *Pastilles, Pastillus, Pastilli*.—Same as troches; in England restricted to those having glyco-gelatin as a base.

23. *Scales, Lamellæ*.—Thin scales, disks, or plates of medicinal substances; in England restricted to gelatin and glycerin, to be dropped into the eye, each weighing  $\frac{1}{80}$  gr. (.0013 Gm.).

24. *Sprays, Nebulæ*.—Usually aqueous medicinal solutions, to be used in atomizers, for throat, etc.

25. *Succus, Succī, Juices*.—Vegetable liquids expressed and preserved with alcohol.

26. *Tablets, Compressed Tablets, Tabellæ*.—These consist of the pure or diluted drug, made to cohere by heavy compression in strong metallic moulds.

27. *Tablet Triturates*.—These consist of the drug along with milk-sugar or cane-sugar, made into a pasty mass with either alcohol, water, or syrup in some proportion, then pressed lightly into suitable moulds and dried. *Dragée* (dra-zha) is the name given in France to the ordinary sugar-coated pill. *Enteric Pills* (Gr. *ἐντερον*, intestine), such as are coated with a substance, as salol, keratin, etc., to allow passage through the stomach intact, thereby not becoming dissolved until the duodenum or intestinal tract is reached. *Concentric Pills* are made of concentric layers of different ingredients to become dissolved and active at various points of the intestinal tract.

#### THE AVENUES BY AND THROUGH WHICH MEDICINES ENTER THE SYSTEM.

1. *By Stomach: Gastro-intestinal Route*.—This is the most common and convenient method. After medicines are swallowed they enter circulation through the walls of the blood-vessels (which permeate the mucous membrane of the stomach and intestines), portal veins, and lacteals; so that when the intestinal contents reach the ileo-cæcal valve they consist of excrementitious matter and food refuse. If the stomach be healthy and empty, crystalloids in solution quickly pass through the vessel-walls; but colloids (albumin, fats, gelatin, gums, etc.) have to be digested and emulsified before they can be absorbed. In the stomach the albuminous drugs (proteids) are transformed, by pepsin and gastric juice, into soluble peptones, and there as such these, along with soluble crystalline salts, diffuse readily into the blood, often giving positive effect within an hour; the sugar, starchy, fatty, gummy, gelatinous, resinous, gumresinous and oleoresinous drugs, without suffering much change from the stomach secretions, pass into

the duodenum, where the bile, intestinal and pancreatic juices, within 3 to 4 hours, convert the starches into sugar (which in part may go finally into lactic acid and fat), emulsify and saponify the fats, oils, etc., separating them into glycerin and fat acids, which latter, meeting alkaline bases, form diffusible soaps; the resins, alone and in combination, within 4 to 10 hours, become broken up by these same alkaline juices (associated alkaline salts often facilitating), and either are converted into a soluble form for systemic ingestion, or simply are eliminated from the liver [whose secretion (bile) they have stimulated], thereby being allowed to pass into the lower intestine to stimulate intestinal gland secretion, or to act somewhere along the tract as a local irritant or stimulant, thereby aiding peristalsis. All drugs taken from the intestinal canal have to pass through the liver before reaching general circulation, and in this passage they may become medicinally very much changed, modified, or even destroyed; again, some drugs may be excreted into the intestine along with the bile, and never reach further circulation, hence these disadvantages, along with that of required palatable form, preclude sometimes the adoption of this avenue.

## 2. *By Skin:*

1. *Hypodermic (Hypodermatic).*—This consists in injecting medicinal solutions (M.5–15; .3–1 Cc.) into subcutaneous areolar tissue with a syringe (needle)—a method always more or less painful. Quick absorption here takes place by the lymphatics and capillary vessels, giving us the advantage of full action of the quantity of drug used, without any possible changes from the intestinal secretions or processes; must here employ only clear, neutral (never acid), aqueous solutions of drugs, as otherwise intractable sores, sloughing, etc., might result around the punctures; must also avoid veins, injecting only on the external parts of the legs, thighs, arms, also abdomen, back, and buttocks (4 Cm.;  $1\frac{3}{4}$ ' behind the great trochanter). In the process of *hypodermoclysis* a sterilized trocar is employed, and several pints of saline solution ( $\frac{7}{10}$ –1 p. c.) injected, to antagonize, or to wash out and dilute any septic poison (uræmia, septicæmia), cholera-collapse, diabetic coma, shock, etc.; here insert trocar in subcutaneous tissue of abdomen or thigh, and control rate of flow alone by elevating or lowering the vessel containing the required amount of liquid; dissipate any tumefaction by careful massage; admit no air or foreign matters.
2. *Epidermic (Epidermatic).*—Here medicines are incorporated in lanolin, or other fats, and rubbed with friction directly upon the skin, thus promoting their passage through and between epidermal cells; best to apply where skin is thinnest (axillæ, groins, abdomen, insides of thighs) in the form of ointments, oleates, or oils. This method is called also *inunction*.
3. *Enepidermic (Enepidermatic).*—Here medicines are applied to the skin without friction; chloroformic and oleic acid solutions of the alkaloids (aconitine, atropine, morphine, strychnine) pass

by osmosis most easily; solutions in a mixture of chloroform and alcohol nearly as fast; aqueous solutions slower, while pure alcohol causes an outward osmotic flow. In this way medicinal effect is secured through plasters and poultices.

4. *Endermic (Endermatic).*—Here we first produce a blister on the skin, by the use of strong ammonia water (saturated cloths) or cantharides (cerate, collodion), remove with scissors the epidermis, and then upon the denuded surface (derma) apply the powdered medicine—morphine, atropine, quinine, strychnine, etc.; at present little employed.

3. *By Rectum.*—This is accomplished by enemas or by suppositories, being best suited to disagreeable tasted alkaloids, acid solutions, etc. While absorption is usually twice as slow by this method as by the stomach, yet salts of atropine and morphine in solution enter circulation just as quickly, while those of strychnine more quickly than even by the mouth.

4. *By Lungs: Respiration.*—Vapors of liquids or solids are inhaled with the air, thereby bringing the system quickly under the drug's influence; this quick action is due to the rapid absorption, owing to the extensive surface (lungs, etc.) to which applied, and to the fact that volatile substances penetrate the tissues most readily. Some vaporize at all ordinary temperatures, others at that of the body, while many have to be heated. Most anesthetics act by this method.

5. *By Arteries: Arterial Transfusion.*—Large quantities of fluid (defibrinated human or lamb's blood— $\text{̄iv}$ –8; 120–240 Cc., etc.) may be introduced into circulation, through the radial or posterior tibial, by the transfusion syringe. This is safer than by the veins, owing to the less likelihood of admitting air (causing fatal syncope) or of producing thrombosis, as the injected solution has to traverse the capillaries prior to reaching the right side of the heart, thus avoiding any likely sudden distention.

6. *By Veins: Intravenous Injection.*—This is the most perilous of all methods, being resorted to only in extreme emergencies to save life; thus blood or milk in hemorrhage, epilepsy, uræmia, cholera-collapse; saline solutions in cholera-collapse, diabetic coma; diluted ammonia water, ether, brandy or whisky in bites of reptiles, venomous insects, hydrocyanic-acid poisoning, opium-narcosis, chloroform-asphyxia. It is better here to inject into a vein of the leg than of the arm, so that the drug may be less concentrated when it reaches the heart, thereby avoiding possibly any cardiac depression.

7. *By External Application.*—Many powdered medicines when dusted on abraded surfaces, or applied by insufflation to the nares, fauces, larynx, become gradually absorbed and affect the system locally and generally; this equally applies to drops and washes when introduced into the eyes and ears, also to atomized vapors, sprays, etc. The method known as *cataphoresis* consists of producing osmosis, through the skin or mucous membrane, from one point to another, of medicines by the galvanic current, the positive pole being medicated

and placed over the affected part, the negative slightly remote ; this is a mechanical action, and is accomplished by covering the seat of pain with a paper, linen, or gelatinous disk moistened with solution of the drug, and placing thereon the anode, or may apply direct the sponge electrode saturated with the medicine; this method affects only tissues between the poles, and solutions of aconite, chloroform, cocaine, and morphine yield good results.

#### THE MEANS BY WHICH MEDICINES ARE TRANSMITTED THROUGH THE SYSTEM.

It was for a long time believed that drugs radiated from the seat of application throughout the system, by the nerves ; this is known now to be false, and, instead, we recognize the blood to be the common carrier ; thus the blood has to take up the drug in solution before there will be other than a local effect, and when once dissolved in it the periodic rounds of circulation are regularly made with this impregnation, so that the system, as a whole, responds to the medicine's influence. As proof of this, we find that blood taken from any portion of the body, near or far from the point of application, contains the drug ; also the blood of persons poisoned when injected into others produces similar poisonous symptoms ; if you interrupt the blood-circulation to any part, no poison will be transmitted to that part ; as other secretions are nourished by the blood, you would expect them also to have similar medical properties, and such is the case—milk, sweat, urine, etc. ; if we inject medicines directly into the blood (a dangerous process), we soon have characteristic action. The blood is enabled to absorb these through the intervention of the veins, lymphatics, and lacteals ; while it eliminates them, even to the extent often of irritation, through the excretory organs, kidneys, bowels, skin, etc.

#### CONDITIONS WHICH MAY MODIFY THE ACTION—HENCE THE DOSE OF DRUGS.

Medicines are not given immediately before or after meals, unless certain conditions urgently demand it ; they enter circulation much quicker on an empty stomach and then also produce best local results, whereas a full stomach not only retards absorption, but renders poisons and irritating chemicals less injurious. The system is most resistant in the morning, when larger quantities of hypnotics, etc., are required than at night. The interval of doses depends upon rate of absorption and elimination of each drug, and usually should be sufficiently brief as to prevent the patient coming from under a continued influence until finally desired. Medicines change or modify directly the action only of those organs and tissues with which they come into immediate contact ; this action may be simply local, or again general (systemic), and while all have one primary (direct) action, they may also produce indirectly (reflexly) one or more secondary (remote) effects.

The identical drug does not give rise to like results in every person,

nor do different specimens of the same drug, when taken in equal quantities, produce the precise effects upon the one individual; for this there are several causes:

1. *Age*.—While the adult dose is about uniform (being based upon the average weight of 150 pounds; 68 Kg.), and holds good between the ages of twenty to sixty, yet that from infancy to majority is variable, and should be computed by the following rules: Dr. Cowling's applies to any age up to and including the twenty-fourth year, and is thus: The age at the next birthday is divided by 24, and that fraction of the adult dose gives the quantity sought—child one year at coming birthday =  $\frac{1}{24}$  of adult dose; gentian, gr. 30, hence  $\frac{1}{24}$  of 30 = gr.  $1\frac{1}{4}$ . Dr. Young's applies to any age up to twelve years, and is thus: The age at the coming birthday divided by that age plus 12—child two years at next birthday =  $\frac{2}{2+12} = \frac{2}{14} = \frac{1}{7}$  of adult dose; cinchona, gr. 40, hence  $\frac{1}{7}$  of 40 = gr.  $5\frac{5}{7}$ . Dr. Brunton's applies to metric doses, and is thus: Multiply the adult quantity by the approaching birthday, and that again by 4, then remove the decimal point two places to the left; adult dose of catechu is 1 Gm., and for a child five years old at its next birthday =  $\frac{1 \times 5 \times 4}{100} = .2$  Gm.

Very old persons are extremely susceptible to strong or even ordinary medication, all doses having usually to be diminished. Children are very acute to opium and many anodynes, yet tolerate larger quantities of purgatives and a few other drugs (castor oil, calomel, rhubarb, cod-liver oil, iron, belladonna, ipecac, pilocarpine, squill, arsenic, hydrated chloral) than the rules would indicate.

2. *Mode of Administration*.—This has much to do with the rate of absorption, hence controls the dose. Thus the dose hypodermically is one-half that by the mouth or one-fourth that by the rectum, and this difference depends upon the rapidity of absorption—the hypodermic being the quickest, the rectum the slowest. On a full stomach, medicines enter circulation much slower than on an empty one.

3. *Form of the Drug*.—This controls largely the rate of absorption, hence, the dosage. Before any substance enters circulation it must be in solution, and the nearer we have medicines to approach the liquid form the quicker will they have effect and the smaller will be the doses required, consequently, it takes less in tincture than in powder or pill form.

4. *Condition of the Drug*.—The same species do not always produce drugs of uniform strength; thus cinchona, opium, nux vomica, rhubarb, senna, etc., are by no means regular, as the total alkaloids of cinchona may range from 2–10 p. c.; opium, 4–24 p. c., etc.; therefore, to have like results varying quantities must be given. This strength-difference is due largely to soil, climate, cultivation, season of year when collected, curing, duration on the market, possible adulterations, etc.

5. *Conditions of the Individual*.—These are not always the same; sex, race, temperament, idiosyncrasy, congenital tolerance, acquired tolerance (mithridatism), climate, occupation, imagination, mental emotion, disease, and habitual use all affect the dosage required in in-



dividual cases. Thus, females demand less than males ; strong, burly races more than weaker ones ; sanguine temperaments cannot tolerate stimulants ; nervous temperaments must use purgatives cautiously ; bilious temperaments need mercurials, while to lymphatic temperaments these are injurious. Idiosyncrasies vary in people—some vomit at the odor of ipecac or purge by smelling croton oil ; others are little or greatly affected by opium, mercury, arsenic, belladonna, cocaine, iodides, etc. Warm climates demand smaller doses of purgatives and larger doses of antiperiodics. Occupation controls largely doses, as those exposed and under hard labor require unlike quantities to those in light pursuits, sedentary habits, indoor surroundings, etc. Imagination has its effect, as in a degree one's frame of mind can will or not will results. Mental emotion, either with or without disease, as a rule, demands larger doses than when free from any undue excitement. Habitual use lessens medicinal power, the dose having to be increased gradually, as with cathartics, opium, arsenic, etc. Disease modifies dose, as in tetanus, peritonitis, cancer, cholera, etc., excessive quantities of morphine are required and well tolerated ; in typhoid fever abnormal amount of stimulants may be used, as alcohol, brandy, etc. ; in pneumonia excessive doses of tartar emetic may be given without nausea, while during menstruation, lactation, pregnancy, etc., smaller doses should be administered.

6. *Incidental Conditions.*—Besides the preceding, we have some other factors influencing the variability of doses : State of the stomach, empty, full, active, sluggish, etc.—under certain disorders it will not assimilate medicines at all, when administration must be by other channels. Cumulative action of some drugs requires cautious doses ; this may arise from slower elimination than absorption—mercury, lead ; or the elimination may suddenly be arrested by the drug causing contraction of renal vessels, when the system has become saturated—digitalis, strychnine ; or again, the intestinal contents may quickly be changed, so that from a slow we get rapid absorption ; rate of excretion modifies doses—when rapid, small and oft-repeated quantities are more advantageous than larger ones, and as an outgrowth of this we have now the praiseworthy tendency of diminished dosage, as with calomel, etc. ; pathological conditions modify the effects of drugs very considerably ; thus antipyretics in fever reduce temperature, but have no effect on it in health ; bromides lessen convulsions in epilepsy, but depress very slightly the normal brain, etc.

7. *Untoward Effects.*—Many drugs produce other than their accustomed action upon certain individuals, made abnormal through habit or inheritance ; such action results not from any drug impurity, but rather from the difference in the drug's primary and secondary effects (often opposite), the organs chiefly affected by the ordinary action of the drug, and the method of drug elimination. Thus an antipyretic, reducing temperature through the skin (this being connected with and controlled by the central nervous system regulating temperature), may produce skin eruptions or excessive perspiration (untoward)—the drug

being eliminated by this channel ; and as temperature cannot be controlled without, at the same time, controlling the vasomotor system regulating the blood supply, we also may have collapse, heart failure, palpitation, eye and ear symptoms. If drug is eliminated by kidneys we may have albuminuria, etc. (untoward) ; hypnotics acting on central nervous system may produce perspiration, skin eruptions, vertigo, heart collapse (untoward) ; astringents may occasion diarrhoea, bloody intestinal discharges (untoward) ; diaphoretics from over-stimulation may cause local pain, etc. (untoward). Thus aconite may produce eruption or itching of the skin ; antipyrine—cyanotic hands, nose, lips, cold extremities ; arsenic—dermatitis, burning of the skin, coryza ; caffeine—insomnia, delirium, tremors, palpitation, tinnitus aurium, gastralgia ; hydrated chloral—nausea, vomiting, purging, inflamed eyes ; digitalis—nausea, indigestion, syncope ; potassium iodide—coryza, acne ; iron—gastric disturbance, headache, constipation ; opium—wakefulness, nausea, vomiting, mental depression ; pilocarpus—dim vision, vomiting, collapse, swollen salivary glands and tonsils, hiccough, strangling ; salicylic acid—headache, tinnitus aurium, acne, blindness ; cinchona—cinchonism, etc. Powerful drugs (tonics, alteratives, etc.), far more than those comparatively inert, tax the inherited and acquired deficiencies, while excessive and continuous strain on inhibitions usually produce affections of inhibitory apparatus as to greatly modify the untoward effects ; these so vary in neurotics as often to cause such nerve-strain of eliminative and assimilative organs as to produce toxins, thereby intensifying or diverting drug's action—etiologic moment.

8. *Incompatibility*.—This often changes the drug's action, producing harmless or harmful compounds, and may be of three kinds :

1. *Chemical*.—This results from double decomposition, new compounds being formed, and with the prescriber may be intentional or unintentional : from the former we may have lime water with mercuric or mercurous chloride ; zinc sulphate in solution with lead acetate ; hydrochloric acid directly to potassium chlorate, etc. ; in all these the new-formed product is the one desired medicinally ; from the latter (unintentional) we may have glucosides (tannin, etc.) ordered with free acids, or emulsions ; alkaloids with alkalies, alkaline salts, iodides or bromides ; tannic and gallic acids with iron salts, alkaloids, tartar emetic, albumin, metallic oxides, gelatin ; vinegars, acetic syrups, and diluted acid solutions with soluble carbonates ; quinine sulphate with potassium acetate ; corrosive mercuric chloride with alkalies, alkali carbonates, iodides, bromides, alkaloids, sulphides, reduced iron, silver nitrate, albumin, gelatin, tannin, etc. Any of the following with other substances should also be watched carefully, as they readily cause precipitation and changes : Chlorine solutions, corrosive mercuric chloride, iodine, iodides, lead salts, iron solutions, potassium acetate, bromide, and permanganate, solution of potassium hydroxide, tannic and gallic acids, diluted hydrocyanic acid, mineral acids, quinine sulphate, silver and zinc salts, tincture of guaiac, chlorates, iodates, picrates, nitrates, dichromates. The accompanying table is from Potter's *Materia Medica*, and serves an admirable purpose in this connection ; P. stands for precipitate.

	Alkaloidal solutions (generally).	Metallic solutions (generally).	Solutions of lead or silver.	Solutions of calcium salts.	Solutions of magnesium salts.	Solutions of albumin or gelatin.
Alkalies . . . . .	P.	P.	P.	P.	P.	
Tannic acid . . . . .	P.	P.	P.			P.
Carbonic acid and carbonates . . . . .	P.	P.	P.	P.	P.	
Sulphuric acid and sulphates . . . . .		P.	P.	P.	P.	
Phosphoric acid and phosphates . . . . .	P.	P.	P.	P.	P.	
Boric acid and borates . . . . .	P.	P.	P.			
Hydrochloric acid and chlorides . . . . .			P.			
Hydrobromic acid and bromides . . . . .			P.			
Hydriodic acid and iodides . . . . .	P.		P.			
Sulphides . . . . .		P.	P.			
Arsenical preparations . . . . .		P.	P.			
Albumin . . . . .		P.	P.			

*Explosions* have resulted by mixing fluidextract of uva ursi or geranium with spirit of nitrous ether; chromic or nitric acid with glycerin; potassium permanganate with glycerin; silver nitrate with creosote; silver oxide with extract of gentian in pill; potassium chlorate with glycerin and tincture of ferric chloride; calcium chloride triturated with sulphur; oxidizing agents with sulphur, charcoal, iodine, phenol (carbolic acid), glycerin, turpentine, etc.; iodine with ammonia; potassium chlorate with catechu. Poisonous compounds result from mixing potassium chlorate with its iodide, forming in the system potassium iodate; potassium chlorate with syrup of iodide of iron, liberating in the system free iodine; diluted hydrocyanic acid or potassium cyanide with calomel, forming corrosive mercuric chloride or mercuric cyanide.

2. *Pharmaceutical*.—This results when substances are mixed and do not produce clear solutions, owing to their different solubility in menstrua—insoluble powders or oil will not mix with water, nor will water with solutions of resins without precipitation—acid quinine solutions with licorice solutions precipitate glycyrrhizin—alcoholic solutions with aqueous solution of hydrated chloral separate the latter on top. In all such cases it is better pharmacy to suspend the separated ingredients by the addition of a mucilage or some emulsifying agent. Under this head it is well to remember the following classes:

1. Alcoholic or resinous tinctures and fluidextracts, essential and fixed oils, copaiba, each precipitate with aqueous preparations.
2. Compound infusion of cinchona with compound infusion of gentian, and this latter with infusion of wild cherry.
3. Spirit of nitrous ether with strong mucilages, tincture of guaiac, solution of potassium bromide or iodide.
4. Alcoholic liquids, tinctures, and fluidextracts with those made with diluted alcohol; also with strong solutions of acacia.
5. Infusions in general with metallic salts—due to gelatinization and behavior of tannic acid.
6. Antipyrine with alkaloids, tincture of iodine, corrosive mercuric chloride, Lugol's solution, spirit of nitrous ether, ferric salts, hydrocyanic, tannic, and nitric acids, phenol (carbolic acid), permanganates, salicylates, hydrated chloral, orthoform.

7. Pepsin with alkalies, alcoholic liquids, mineral salts, tannates, heat ( $100^{\circ}$  C. ;  $212^{\circ}$  F.).

8. Salicylic acid with iron compounds, alkali iodides, spirit of nitrous ether.

3. *Therapeutical*.—This results where two drugs of opposite medicinal properties are given together—the one neutralizing somewhat the other : astringents with purgatives ; aconite or veratrum with digitalis ; atropine, belladonna, hyoscyamus, or stramonium with caustic alkalies, pilocarpine, physostigmine (eserine), or morphine ; acids with alkalies ; arsenic with hydrated ferric oxide ; phenol (carbolic acid) or lead salts with magnesium or sodium sulphate ; cannabis indica with strychnine, picrotoxin, or acids ; cocaine or gelsemium with morphine ; conium with strychnine, picrotoxin, or stimulants ; corrosive mercuric chloride with tannin or vegetable astringents ; homatropine with physostigmine (eserine) ; opium and its alkaloids with potassium permanganate, belladonna, hyoscyamus, or stramonium ; oxalic acid with calcium carbonate ; silver nitrate with sodium chloride ; strychnine or picrotoxin with hydrated chloral and potassium bromide ; tartar emetic with tannin. Sometimes physiological antagonists are prescribed together purposely, in order to have the action of the one to guard that of the other, as atropine with morphine (hypodermically).

#### THE CLASSIFICATIONS OF MEDICINES.

There have been many systems brought forward to facilitate the studying of drugs, and it is owing, possibly, to the number that authors observe little uniformity in the arrangement followed. It has been thought wise to outline the five most important. Of these, the first and fourth alone are by their nature sufficiently comprehensive to include all organic and inorganic drugs without a single omission. The others (three) are but scientific systems applicable only to the organic medicines, and, as such, are mostly recommended by pharmaceutic and chemical investigators.

I. ARRANGEMENT BY ALPHABETIC SEQUENCE.—This is the least scientific but the most popular ; in fact, it is not a true system, as no tacit relationship in any particular exists between the associated subjects, save that of initial letter in spelling, which possibly can offer to the student only the trifling advantage of lexical convenience.

II. ARRANGEMENT BY CHEMICAL CONSTITUENTS.—From a very early period organic drugs (vegetable and animal) were known to yield some of their activity to water and spirit, but the precise nature of the active constituents were little sought after until the beginning of the last century. The intelligent development of chemistry has been the means of separating these potentials and assigning their individual nature, to the extent of formulating a system or an arrangement of plants into groups dependent upon their chief constituent furnishing the medicinal properties, as : alkaloid, glucoside, fixed oil, volatile oil, resin, starch, etc. This classification, although best for the chemist in

his laboratory investigation, somewhat assists the botanist, since certain genera and even families (natural orders) occasionally have similar constituents: Labiatae (volatile oil), Solanaceae (mydriatic alkaloids), Convolvulaceae (cathartic resin), etc. Its great drawbacks consist in the variability of the nature assigned these constituents from time to time through the advance of chemical science: thus, a neutral principle to-day may be an alkaloid to-morrow; and, again, nearly all drugs have more than one constituent, the most abundant often being the least active, and which should govern its classification is not always easy to decide. To the general student, however, it is of considerable value, as it furnishes him a knowledge of the character, name, and number of the possible drug constituents, also impresses upon him the great difference between the crude drug and its active principle, and beyond all—that in every case it is the latter that furnishes the drug's working capacity.

1. *Amylaceous*.—Those containing starch as their chief medicinal principle: inula, lappa, cetraria, etc.

2. *Mucilaginous, Gummy*.—Those having considerable mucilage or gum: acacia, tragacanth, flaxseed, etc.

3. *Saccharine*.—Those containing much sugar in some form: manna, glycyrrhiza, triticum, etc.

4. *Acidulous*.—Those containing chiefly an organic acid: lemon, orange, tamarind, rubus, etc.

5. *Oleaginous*.—Those containing: (a) Volatile or essential oil: (1) Terpenes,  $C_{10}H_{16}$ : turpentine, cubeb, juniper, etc. (2) Oxygenated,  $C_{10}H_{18}O$ : cinnamon, anise, fennel, etc. (3) Sulphurated,  $C_{12}H_{22}S_2$ : mustard, asafetida, allium. (4) Nitrogenated,  $C_7H_5O$  (HCN): bitter-almond, wild cherry, peach, etc. (b) Fixed oils (Compound ethers) which leave a permanent stain: olive, almond, castor oils, etc.

6. *Resinous*.—Those containing much resin: (a) Natural exudations: mastic, guaiac, benzoin. (b) Extracted by alcohol, etc., from resinous drugs: podophyllum, jalap, sumbul, etc.

7. *Gumresinous*.—These contain milky exudations consisting of one or more gums and resins: (a) With volatile oil: ammoniac, asafetida, myrrh, etc. (b) Without volatile oil: gamboge, scammony, etc.

8. *Oleo-resinous*.—Those containing a volatile oil holding in solution a resin: turpentine, copaiba, Burgundy pitch, etc.

9. *Balsamic*.—Those containing a liquid, semi-liquid, or solid vegetable product composed of a resin or oleoresin, an odorous principle, and either one or both benzoic and cinnamic acids: peru, tolu, storax, etc.

10. *Glucosidal*.—These contain an organic principle converted by mineral acids, alkalies, or ferments into glucose and an allied organic compound; they may be neutral or acid, and sometimes form salts; nearly all are soluble in alcohol: salicin, gentiopicrin, cathartic acid, tannin, etc.

11. *Neutral Principles*.—These, sometimes called bitter principles from their bitterness, are plant-constituents, either neutral or feebly

acid, and, when possible, form salts with alkalies; they differ from glucosides in not splitting into glucose, and from alkaloids in not being precipitated by tannin or mercuric-potassium iodide: aloin, elaterin, picrotoxin, santonin, etc.

12. *Alkaloidal*.—These contain alkaloids composed of carbon, hydrogen, and nitrogen alone, if liquid (amines), and additionally oxygen, if solid (amides); sometimes they are called vegetable alkalies, and, in fact, are related to ammonia, as when heated with alkalies ammonia is given off: quinine, morphine, cocaine, atropine, nicotine, coniine, etc.

III. ARRANGEMENT BY MORPHOLOGY AND ANATOMY.—This system is preëminently adapted for those wishing to become perfectly familiar with the general make-up of the various official plant-parts; the inner structural resemblances and differences of each group-member, as well as the relationship that each group itself sustains to its neighbors. In other words, it is most suited to laboratory work where time is afforded to make cross-sections, stainings, tests, dissections of fibro-vascular bundles, medullary sheaths, rays, etc., thereby readily distinguishing the true and genuine article from that which is false and spurious.

1. *Roots, Radices*: (a) Monocotyledonous: sarsaparilla. (b) Dicotyledonous. (1) Fleshy: stillingia, sumbul, calumba. (2) Woody: glycyrrhiza, pareira, krameria, ipecac, etc.

2. *Rhizomes, Rhizomata*: (a) Cryptogamous: aspidium. (b) Monocotyledonous. (1) Without roots: ginger, calamus, triticum. (2) With roots: veratrum, cypripedium, iris. (c) Dicotyledonous. (1) Without roots: sanguinaria, geranium, podophyllum. (2) With roots: valerian, arnica, serpentaria, hydrastis, spigelia, etc.

3. *Tubers and Bulbs, Tubera et Bulbi*: (a) Monocotyledonous tubers: colchicum, salep, indian turnip. (b) Monocotyledonous tunicated bulbs: squill, garlic, etc. (c) Dicotyledonous tubers: jalap, aconite, corydalis.

4. *Twigs and Woods, Stipites et Ligna*: (a) Twigs: dulcamara, scoparius. (b) Woods: quassia, guaiacum, hæmatoxylon, etc.

5. *Barks, Cortices*: (a) Bitter and astringent: cinchona, wild cherry, viburnum. (b) Astringent: white oak, rubus, pomegranate. (c) Bitter, not aromatic: frangula, cascara sagrada, juglans. (d) Acrid or pungent: xanthoxylum, mezereum, euonymus. (e) Mucilaginous: ulmus. (f) Aromatic with oil- or resin-cells: cinnamon, saffras, cascarilla, etc.

6. *Leaves and Leaflets, Folia et Foliola*: (a) Entire. (1) Aromatic, glandular, coriaceous: rosemary, pilocarpus, eucalyptus. (2) Not aromatic, glandular, or coriaceous: uva-ursi, senna, coca. (b) Toothed or crenate. (1) Coriaceous: chimaphila, buchu, eriodictyon. (2) Not coriaceous: stramonium, hyoscyamus, digitalis, etc.

7. *Herbs, Herbæ*: (a) Cryptogamous: chondrus, cetraria, maiden-hair, etc. (b) Dicotyledonous. (1) Petals distinct: pulsatilla, chelidonium, scoparius. (2) Petals united: eupatorium, lobelia, peppermint (*Labiatae*). (3) Petals absent: indian cannabis.

8. *Leafy Tops, Cacumina Summitates*: savine, red cedar, thuja, etc.

9. *Flowers and Petals, Flores et Petala*: (a) Unexpanded: cloves, santonica. (b) Expanded. (1) Polypetalous: orange, kousso, rose. (2) Gamopetalous: Compositæ, sambucus, lavender, etc.

10. *Fruits, Fructus*: (a) Multiple: juniper, hops, fig. (b) Simple. (1) Drupes: phytolacca, cubeb, black pepper, prune. (2) Berries: lemon, capsicum, colocynth. (3) Achenes: barley, lappa, indian cannabis. (4) Cremocarps: Umbelliferae. (5) Capsules: cassia fistula, cardamom, vanilla. (6) Parts of fruit: lemon, tamarind, etc.

11. *Seeds, Semina*: (a) Monocotyledonous (albuminous): sabadilla, colchicum, areca, etc. (b) Dicotyledonous. (1) Exalbuminous: almond, pumpkin, physostigma, mustard. (2) Albuminous: nux vomica, staphisagria, linseed, nutmeg, stramonium.

12. *Drugs with Cellular Structure*: (a) Not farinaceous: nutgall, ergot, mace, saffron, lupulin, lycopodium. (b) Farinaceous: starch, tapioca, barley, etc.

13. *Drugs without Cellular Structure*: (a) Extracts and inspissated juices, *Extracta et succi inspissati*. (1) Wholly or partially soluble in water or alcohol: guarana, opium, lactucarium, aloes, extract of glycyrrhiza, extract of hæmatoxylon, catechu, gambir, kino. (2) Insoluble in water or alcohol: gutta percha, elastica, etc. (b) Sugars, *Sacchara*: sugar, manna, honey. (c) Gums, *Gummata*: acacia, tragacanth, etc. (d) Gumresins, *Gummi resinæ*. (1) With volatile oil: asa-fetida, ammoniac, myrrh. (2) Without volatile oil: gamboge, scammony. (e) Resins, *Resinæ*. (1) Without benzoic or cinnamic acid: elaterium, mastic, rosin, guaiac. (2) With benzoic and cinnamic acids: benzoin, dragon's blood. (f) Balsams and oleoresins, *Balsama et oleoresinæ*. (1) Without benzoic or cinnamic acid: copaiba, turpentine, Burgundy pitch, tar. (2) With benzoic or cinnamic acid: peru, tolu, storax. (g) Volatile oils and camphors, *Olea volatilæ et camphoræ*. (1) Volatile oils—arranged in sequence of families (natural orders), containing a volatile portion, elæopten, and a less volatile portion, stearopten or camphor: terpenes, oxygenated, nitrogenated, sulphurated. (2) Camphors: camphor, thymol, menthol, etc. (h) Fixed oils and waxes, *Olea pinguis et ceræ*. (1) Liquid fats: almond, olive, linseed, cod-liver, croton, castor oils. (2) Solid fats: oil of theobroma, lard, suet. (3) Waxes: spermaceti, wax.

14. *Drugs of Animal Origin*: (a) Animals: cantharides, cochineal, leech. (b) Animal products, tissues, secretions: eggs, isinglass, musk, pepsin, ox-gall. (c) Calcareous skeletons and concretions: coral, cuttlefish bone, oyster-shell.

IV. ARRANGEMENT BY THERAPEUTIC EFFECT.—This is possibly the least difficult and most useful to the average physician. In a way it is scientific, but since many medicines possess more than one property, with the same or varying dosage, it often becomes more or less confusing as to the group to which such should be assigned; then again this system has become somewhat flexible and lacking in perfect uniformity through the preferences of those giving it prior sanction. Thus all drugs may be placed into a dozen general classes, each with many

subdivisions : those acting on protoplasm, muscle, nerves, spinal cord, brain, special senses, reproduction, circulation, digestive system, tissue-changes, excretion, generative system ; or with no less equity the same number may be retained, but in substance somewhat modified, thus : drugs acting upon organisms, blood, cardiac mechanism, vessels, skin, urinary system, bodily heat, respiration, digestive apparatus, nervous and muscular systems, organs of generation, metabolism ; or again the general classes may be omitted, simply using the names descriptive of the various therapeutic effects, arranged alphabetically, or according to real or fancied importance. From its universal favor and the usage of its terms throughout this work, we give yet another modification which has some advantages.

### I. AGENTS PROMOTING CONSTRUCTIVE METABOLISM (METAMORPHOSIS).

1. *Restoratives* (L. *restaurare*, to restore).—These restore or renew strength or vitality : (a) Foods, Aliments—which maintain some vital process, or renew some structural material, while medicines can modify only some vital action. They are derived from the vegetable, animal, and mineral kingdoms, and in nature are recognized as being either : *oxidizable*—heat-producing and force-forming : carbon compounds, fat, sugar, starch, gum, etc. ; *nitrogenous*—flesh-forming : albumin, casein, fibrin, etc. ; *unoxidizable* or *incombustible* : metallic salts, water, etc. ; (b) Digestive ferments—which are animal and vegetable substances for aiding digestion when the normal alimentary secretions are inefficient : pepsin, pancreatin, papain, diastase, ingluvin, etc. ; (c) Digestive acids—which check the production of glands having acid secretions, but increase those having alkaline secretions : diluted hydrochloric, nitric, sulphuric, nitro-hydrochloric, lactic, phosphoric, etc. ; (d) Fats and fatty oils—which form the molecular basis of the chyle, are indeed necessary for the digestion of nitrogenous food, and by oxidation become the chief producers of vital force and heat : cod-liver, cotton-seed, linseed, olive, sweet-almond, theobroma ; (e) *Hæmatics* (Gr. *αἱματικός*, of the blood)—which increase the amount of hæmatin in the blood, improving its quality by enriching the red corpuscles : salts of iron, manganese, chalybeate waters, etc. ; (f) *Tonics* (Gr. *τονικός*, tone)—which improve the tone of specific tissues, restoring energy and strength to the entire debilitated system, by imperceptibly stimulating vital functions. (1) Mineral : phosphorus, phosphates, phosphites, bismuth, arsenic, etc. (2) Vegetable : (a) Simple Stomachic Bitters, containing a bitter principle : gentian, calumba, quassia, chirata, calendula ; (b) Aromatic Bitters, containing a volatile oil, bitter principle, resin, tannin : serpentaria, wild cherry, eupatorium, anthemis, matricaria.

2. *Antiperiodics* (L. *anti*, opposed to, + *periodicus*, periodic, period).—These prevent recurrence of or modify certain periodic febrile diseases by arresting further development in the blood of successive crops



of pathogenic organisms causing the disorder: cinchona alkaloids, eucalyptus, salicin, arsenic, etc.

3. *Antipyretics, Febrifuges* (Gr. *ἀντί*, against, + *πυρετός*, fever; L. *febris*, fever, + *fugare*, to put to flight).—These reduce abnormally high body-temperature, either by decreasing heat-production, or increasing heat-loss; the former condition being effected by (1) lessening tissue-change, (2) reducing circulation; the latter by (1) dilating the skin-vessels, thereby increasing radiation, (2) causing perspiration and its evaporation, (3) abstracting body-heat, through cold applications: cinchona alkaloids, acetanilide, antipyrine, phenacetin, salol, phenol (carbolic acid), creosote, aconite, veratrum, cold bath, pack, or sponging, purgation, venesection.

4. *Antiphlogistics* (Gr. *ἀντί*, against, + *φλογιστός*, burning).—These reduce inflammation of serous membranes: mercury, opium, etc.; respiratory tract and organs: aconite, tartar emetic, etc.; and puerperal metritis; veratrum, ergot, cold, purgation, etc.

## II. AGENTS PROMOTING DESTRUCTIVE METABOLISM (METAMORPHOSIS)—INCREASE WASTE.

5. *Semi-alteratives, Alkalies*.—These, before meals, stimulate acid and check alkaline secretions when placed in contact with the mouths of the gland-ducts producing them; when administered after meals, they may be (1) Direct—which lessen the stomach's acidity. (2) Indirect—which have only a remote effect, being oxidized in the blood, and excreted as carbonates in the urine, thereby lessening its acidity: potassium carbonate and bicarbonate, solution of potassium hydroxide, sodium carbonate and bicarbonate, solution of sodium hydroxide, ammonium, lithium, and magnesium carbonates, magnesium oxide, lime water, calcium carbonate, aromatic spirit of ammonia, potassium and sodium acetates, potassium, sodium, and lithium citrates, potassium tartrate and bitartrate, vegetable acids.

6. *Alteratives*.—These alter or change morbid conditions, by furthering metabolism, and modify nutritive processes: iodine, iodides, arsenic, antimony, mercury, sulphur, sulphides, sulphites, phosphorus, sarsaparilla, guaiacum, mezereum, stillingia, colchicum, xanthoxylum, hydrastis, phytoacca, sassafras, cod-liver oil. Alteratives are called also *Resolvents* and *Discutients* (L. *resolvere*, to resolve, disperse; *discutere*, to disperse) from the fact that they promote absorption of inflammatory deposits, either by stimulating the lymphatic glands, or promoting the imbibition of medicinal or nutritive material in the system.

7. *Astringents* (L. *astringere*, to draw close, contract).—These contract muscular fibre by direct irritation (local), and condense other tissues by precipitating the albumin and gelatin (remote). 1. Mineral: salts of silver, copper, lead, zinc, bismuth, and aluminum. 2. Vegetable: tannic and gallic acids, nutgall, white oak, geranium, gambir, catechu, kino, krameria, hæmatoxylon, hamamelis, red rose, uva-ursi.

### III. AGENTS PROMOTING THE DESTRUCTION OF MICROBES, PARASITES, ETC.

8. *Antizymotics* (Gr. ἀντί, against, + ζυμωτικός, fermentation).—These arrest fermentation dependent upon organic ferments (enzymes): diastase, pepsin, ptyalin; or upon organized ferments: yeast, bacteria, etc.: (a) *Antiseptics* (Gr. ἀντί, against, + σήπτικός, rotting)—which prevent or retard septic decomposition, by killing the bacilli producing it, or by arresting their development: corrosive mercuric chloride, hydrogen peroxide, potassium permanganate, sulphurous acid, phenol (carbolic acid), creosote, lysol, thymol, eucalyptol, menthol, sodium borate, boracic acid, chlorine, zinc chloride; (b) *Disinfectants* (L. *dis*, *di*, in two, apart, from, + *inficere*, *infectus*, infect(ion))—which destroy specific germs communicating disease (mostly microbes), by (1) acting as oxidizants, (2) combining with albumin, (3) chemically combining to form substitution-compounds, (4) arresting molecular changes, (5) altering the reaction of the media containing the germs: heat (110–121° C.; 230–250° F.), lime, chlorinated lime and soda, ferrous sulphate, zinc chloride, potassium permanganate and dichromate, sulphurous and nitrous acids, sulphur dioxide, formaldehyde, air, water, fire; (c) *Deodorants* (L. *de*, from, + *odorare*, *odoran(t)s*, smelling)—which destroy foul odors. These may be volatile (oxidizing and deoxidizing) agents, that act chemically on obnoxious gases: chlorine, sulphur dioxide, hydrogen dioxide, formalin; or non-volatile (chiefly absorbents) agents that act by condensing and decomposing the effluvia: potassium permanganate, charcoal, earth, lime, ferrous sulphate, etc.

9. *Parasiticides*, *Germicides* (Gr. παρά, besides, upon, + στέιν, to feed; L. *parasitus*, parasite, + *cedere*, to kill).—These kill animal and vegetable parasites existing upon the system, being usually applied in the form of lotions, solutions, washes, ointments, and oleates: staphisagria, corrosive mercuric chloride, mercuric nitrate and oxide, ammoniated mercury, sulphur, sulphur iodide, phenol (carbolic acid), iodoform, aristol, resorcin, naphthalene, betanaphthol, creosote, guaiacol.

### IV. AGENTS ACTING ON THE NERVOUS SYSTEM (NEUROTICS, NERVINES).

10. *Cerebral Excitants*, *Stimulants*, *Antispasmodics* (L. *stimulare*, *stimulus*, to urge, stimulate, a goad, excitant; Gr. ἀντί, against, + σπασμός, a spasm).—These increase the functional activity of the brain without causing subsequent depression or suspension of the cerebral functions: valerian, asafetida, sumbul, musk, camphor, guarana, caffeine (theine), alcohol.

11. *Cerebral Depressants*, *Sedatives* (L. *sedare*, *sedatus*, to allay, calm, a pacifier, tranquillizer).—These lower or suspend the higher brain functions after a preliminary stage of excitement: (a) *Narcotics* (Gr. νάρκη, numbness, stupor)—which at first excite and stimulate all

the body functions, then cause profound sleep, stupor, coma, insensibility, and death by paralyzing the medulla-centres governing respiration and other vital functions: opium, morphine, indian cannabis, lactucarium, cimicifuga; (b) *Hypnotics, Soporifics, Somnificants* (Gr. *ὑπνος*, sleep; L. *sopor*, heavy sleep, *somnus*, sleep, + *facere*, to make)—which produce sleep, leaving undisturbed the normal relationship of the mental faculties to the external world; in a broad sense these include narcotics and anæsthetics: hydrated chloral, sulphonal, trional, paraldehyde, chloralformamide, urethane, potassium, sodium, and ammonium bromides; (c) *Anodynes, Analgesics* (Gr. *ἄν*, not, + *δύναμις*, *ἄλγος*, pain, without pain, cures pain)—which relieve pain by either depressing sensory centres or impairing nerve-fibre conductivity: opium, morphine, belladonna, hyoscyamus, stramonium, coca, cocaine, hops, antipyrine, acetanilide, phenacetin; (d) *Anæsthetics* (Gr. *ἄν*, not, + *αἰσθητόν*, sensible, insensible effect produced)—which reduce sensory nerve-functions until nerves cannot receive or conduct sensation; some directly depress the skin's end-organs, others impair the sensory nerve conductivity, others reduce local circulation; these are mostly volatile substances, whose vapor when inhaled sufficiently causes complete unconsciousness, loss of sensation and motion; anodynes only diminish, while anæsthetics temporarily destroy skin and mucous membrane sensibility: ether, chloroform, nitrous oxide, ethyl bromide, methylene bichloride.

12. *Motor Excitants (Excito-motors, Spinants)*.—These increase functional activity of the motor apparatus and spinal cord, causing, in large doses, disturbances of motility, increased reflex excitability, and tetanic convulsions, finally paralysis from over-stimulation: nuxvomica, strychnine, ignatia, picrotoxin, electricity.

13. *Motor Depressants (Depresso-motors)*.—These lower functional activity of the motor apparatus and spinal cord, in large doses directly paralyzing them: physostigma, conium, gelsemium, potassium, sodium, ammonium, and lithium bromides, amyl nitrite, nitroglycerin, lobelia, alcohol, ether, chloroform.

14. *Mydriatics* (Gr. *μυδρίασις*, enlarged pupil).—These dilate the pupil; some act locally, others systemically, causing paralysis of the ciliary muscle: atropine, homatropine, hyoscyamine, daturine, duboisine, cocaine.

15. *Myotics* (Gr. *μύειν*, to close, shut).—These contract the pupil by stimulating the circular muscular fibres of the iris, and by contracting the ciliary muscle so that the eye is accommodated only for near objects: physostigmine, pilocarpine, morphine, anæsthetics (at first), muscarine.

## V. AGENTS ACTING ON THE RESPIRATORY SYSTEM (RESPIRATION).

16. *Respiratory Stimulants*.—These exalt the functions of the respiratory centre in the medulla, affording deeper and quicker breathing: strychnine, atropine, digitalis, apomorphine, duboisine, emetine, opium (small doses).

17. *Respiratory Sedatives (Depressants)*.—These lower the respiratory centre's activity, affording shallow and slow respirations: opium, physostigma, gelsemium, aconite, veratrum, conium, muscarine, hydrocyanic acid.

18. *Pulmonary Sedatives* (Gr. πλέυμων, πνέυμων, lung; L. *pulmonarius*, pertaining to or affecting the lungs).—These lessen the irritability of the respiratory nerves or centre, thereby diminishing cough and dyspnoea. Some directly depress the centre, others remove irritating substances from the passages, others lessen local congestion, others lower the excitability of the vagus end-organs and afferent filaments of the lungs and respiratory tract: opium, morphine, codeine, hydrocyanic acid, belladonna.

19. *Sternutatories, Errhines* (L. *sternutare*, to sneeze; Gr. ἐν, in, + ῥιν, the nose).—The former cause sneezing; the latter increase nasal secretion when applied to mucous membrane in powdered form: ipecac, quillaja, ammonia, cubeb, etc.

20. *Ciliary Excitants* (L. *cilium*, an eyelid, hair-like process).—These, when dissolved in the mouth, promote bronchial mucous expectoration through reflex excitation of the bronchial and tracheal cilia: acacia, ammonium and sodium chlorides, potassium chlorate.

21. *Expectorants* (L. *ex*, out of, + *pectus, pectoris*, the breast).—These change the broncho-pulmonary mucous membrane secretion, promoting its expulsion: (a) Nauseating (Sedative)—which, in large doses, cause vomiting, thereby acting mechanically in expelling the mucus, and, in small doses, increase osmosis from the inflamed mucous membrane; they may increase secretion and lower blood-pressure: tartar emetic, ipecac, apomorphine, lobelia, pilocarpus; (b) Stimulating—which stimulate the bronchial mucous membrane that eliminates them, altering the secretion and facilitating expectoration: senega, squill, ammonium carbonate and chloride, benzoin, balsams of Peru and Tolu, tar, turpentine, garlic, onion, licorice, saccharine substances, ammoniac.

## VI. AGENTS ACTING ON THE CIRCULATORY SYSTEM (CIRCULATION).

22. *Cardiac Stimulants (Tonics; L. cardiacus; Gr. καρδία, heart)*.—These stimulate the cardiac muscle, slowing and strengthening its contractions; excessive quantities may cause sudden death by syncope: digitalis, strophanthus, scoparius, convallaria, cimicifuga, nitroglycerin, nitrites, alcohol, ether, ammonia, heat, galvanism, chloroform.

23. *Cardiac Depressants (Sedatives)*.—These lessen the force and frequency of the heart's action, controlling its over-action and palpitation; especially do they slow the pulse in sthenic fevers due to local inflammation: aconite, veratrum, tartar emetic, senega, pilocarpine, hydrocyanic acid, emetine, quinine (full doses), pulsatilla, grindelia, cold.

## VII. AGENTS ACTING ON THE DIGESTIVE SYSTEM (DIGESTION).

24. *Sialagogues* (Gr. *σάλαιον*, saliva, + *ἄγειν*, *ἀγωγός*, to lead, leading forth).—These promote the secretion and flow of saliva and buccal mucus: (a) Topical—which act through reflex irritation, caused by taking something into the mouth: capsicum, ginger, cubeb, mustard, tobacco, pyrethrum, horse-radish, alkalies; (b) General—which act through systemic influence on the glands or their secretory nerves during the drug's elimination: pilocarpus, mercurials, antimonials, iodine compounds, physostigma.

25. *Refrigerants* (L. *refrigerare*, to cool).—These allay thirst, giving the sensation of coolness: vegetable and mineral acids (diluted), fruit juices, ice water, effervescing drinks, diaphoretics.

26. *Dental Anodynes*.—These are used locally in toothache due to caries, thus exposing a nerve filament: aconite, cocaine, opium, morphine, phenol (carbolic acid), creosote, oils of cloves and peppermint, hydrated chloral.

## VIII. AGENTS ACTING ON THE EXCRETORY SYSTEM (EXCRETION).

27. *Carminatives, Aromatics* (L. *carminare*, *carminativus*, to expel wind).—These expel gases from the stomach and intestines by increasing peristalsis, stimulating the circulation, and relaxing the cardiac and pyloric orifices; also act as diffusible stimulants to the body and mind: cardamom, capsicum, ginger, peppermint, spearmint, cinnamon, nutmeg, lavender, calamus, orange, anise, caraway, coriander, fennel, pimenta, pepper, mustard, cloves, asafoetida, and volatile oil of each.

28. *Emetics* (Gr. *ἔμετος*, vomiting).—These cause vomiting: (a) Local—which, by reflex action, irritate the end-organs of the gastric, pharyngeal, or œsophageal nerves: zinc and copper sulphates, mercury subsulphate, alum, mustard, tepid water; (b) Systemic (General)—which act by directly stimulating the vomiting-centres through circulation: ipecac, apomorphine, tartar emetic, senega, squill, lobelia, sanguinaria, compound syrup of squill.

29. *Antiemetics*.—These lessen nausea and vomiting: (a) Local—which produce a sedative action on the end-organs of the gastric nerves: ice, phenol (carbolic acid), bismuth subnitrate and subcarbonate, cerium oxalate, creosote, small doses of calomel or ipecac, hot water, opium, cocaine; (b) General—which act by reducing the irritability of the vomiting-centre in the medulla: opium, bromides, morphine, codeine, hydrated chloral, alcohol, amyl nitrite, food, brandy.

30. *Cathartics, Purgatives* (Gr. *καθαρτικός*, cleansing; L. *purgare*, to cleanse).—These increase or hasten intestinal evacuations: (a) *Aperients, Laxatives* (L. *aperire*, to open; *laxare*, to loose)—which excite moderate peristalsis, giving soft movements without irritation: magnesia, manna, sulphur, tamarind, almond and olive oils, figs, prunes, oatmeal; (b) *Simple Purgatives*—which cause active peristalsis

and stimulate secretion of the intestinal glands, giving one or more copious, semi-fluid movements accompanied by some irritation and griping: aloes, calomel, castor oil, cascara sagrada, rhubarb, senna, small doses of salines, drastics, cholagogues; (c) *Saline Purgatives*—which stimulate the intestinal glands, increase peristalsis and osmosis, causing watery stools; magnesium sulphate and citrate, potassium sulphate, tartrate and bitartrate, sodium sulphate, phosphate and chloride, potassium and sodium tartrate; (d) *Drastic Purgatives* (Gr. *δρδω*, *δραστικός*, to act, active). These often are called simply cathartics, and act more intensely than the preceding, causing violent peristalsis, watery stools, griping, tenesmus, borborygmus, mucous membrane irritation, and exosmosis of serum; large doses become irritant poisons: colocynth, jalap, gamboge, scammony, croton oil; (e) *Hydragogue Purgatives* (Gr. *ὑδωρ*, water, + *ἄγειν*, *ἀγωγός*, to lead, leading forth)—which remove much water from the vessels: croton oil, elaterium, gamboge, potassium bitartrate, large doses of salines and drastics; (f) *Cholagogue Purgatives* (Gr. *χολή*, bile, + *ἄγειν*, *ἀγωγός*, to lead, leading forth)—which stimulate bile flow causing free purgation of green-colored (bilious) and liquid stools: mercurials, aloes, rhubarb, podophyllin, euonymin, iridin, leptandrin.

31. *Diuretics* (Gr. *δια*, through, + *οὔρειν*, to urinate).—These increase renal secretion, either by raising the local or general blood-pressure, thereby increasing renal circulation (blood-supply), or by stimulating the secreting cells or nerves of the kidneys, or by washing out the kidneys with much water taken at night or early morning; (a) *Refrigerant*—which excite the renal epithelium, producing a hyperæmic condition of the kidneys and an increased amount of water in the urine; they depress the heart and general circulation: potassium acetate, citrate and bitartrate, ammonium and sodium acetates, lithium carbonate and citrate, magnesium citrate and sulphate, water, milk, cold applications; (b) *Hydragogue*—which largely increase the amount of water in the urine, owing to raising arterial pressure, locally or generally: digitalis, strophanthus, spirit of nitrous ether, nitrites, squill, cimicifuga, scoparius; (c) *Stimulant* (blennorrhetics)—which act directly upon the renal tissue, by which they are to a great extent eliminated from the body: buchu, copaiba, cubeb, matico, pareira, uva-ursi, savine, juniper, chimaphila, taraxacum, cantharides, turpentine, oil of santal, corn silk, apocynum.

32. *Antilithics, Lithotriptics* (Gr. *ἀντί*, against, + *λίθος*, stone, + *τριβειν*, to rub).—The former prevent the formation of urinary and biliary concretions in the excretory passages; the latter dissolve them when formed: *biliary calculi*: alkaline waters, turpentine, etc.; *vesical calculi*: (1) uric acid or urates: alkaline salts, magnesium citro-borate, etc.; (2) calcium oxalate: acids, carbonated waters, etc.; (3) phosphatic deposits (*calculi*): ammonium benzoate, nitric acid, etc.

33. *Diaphoretics, Sudorifics* (Gr. *δια*, through, + *φορῆν*, to carry; *L. sudor*, sweat, + *facere*, to make).—These increase the action of the skin, causing sweat-secretion; are called sudorifics when the secretion

is so profuse as to form beads on the surface: (a) Simple—which enter circulation and stimulate the sudoriferous glands, by which they are eliminated: pilocarpus, ammonium acetate and citrate, sarsaparilla, guaiacum, mezereum, sassafras, senega, serpentaria, salicylates; (b) Nauseating—which relax and dilate the superficial capillaries: ipecac, tartar emetic, opium, Dover's powder, alcohol, ether, spirit of nitrous ether, lobelia, tobacco, vapor and Turkish baths, wet pack, hot drinks; (c) Refrigerant—which reduce circulation by acting on the sweat-centres in the spine and medulla: potassium citrate, aconite, veratrum, tobacco, lobelia, pilocarpus, spirit of nitrous ether, opium.

34. *Antihydrotics, Anhydrotics* (Gr. *ἀντί*, against, *ἀν*, not, + *ἰδρώς*, sweat).—These check perspiration by reducing the action of the sweat-glands, or the excitability of the sweat-centres, or the circulation in the skin: belladonna, chloralformamide, muscarine, pilocarpine, strychnine, quinine, etc.

35. *Anthelmintics* (Gr. *ἀντί*, against, + *ἐλμυνθ*, a worm).—These destroy (*Vermicides*, L. *vermis*, worm, + *cædere*, to kill) or expel (*Vermifuges*, L. *vermis*, worm, + *fugare*, to put to flight) intestinal worms. Vermifuges: castor oil, jalap, scammony. Vermicides, for: (a) Thread worms (*Oxyuris vermicularis*): vegetable astringents, alum, iron sulphate, aloes, tannin, lime water, quassia, all by enema; (b) Round worms (*Ascaris lumbricoides*): santonin, spigelia, chenopodium, each in combination with either calomel (castor oil), senna, or compound jalap powder; (c) Tape worms (*Tenia solium* +) *Tæniifuges*: aspidium, kamala, koussou, pomegranate, pumpkin seed, turpentine.

#### IX. AGENTS ACTING ON THE REPRODUCTIVE SYSTEM (GENERATION).

36. *Emmenagogues* (Gr. *ἐμμηνοσ*, monthly, + *ἀγειν*, *ἀγωγός*, to lead, leading forth).—These restore the menstrual function, either by stimulating directly the uterine muscular fibre, or indirectly enriching the blood, thus toning up the nervous system: (a) Direct—which act locally on the uterus: ergot, rue, tansy, savine, cantharides, myrrh, guaiacum, apiol, hedeoma, cimicifuga, caulophyllum, pulsatilla, potassium permanganate; (b) Indirect—which act generally on the system: iron, manganese, quinine, strychnine, aloetic purgatives, tonics, hot hip baths, cod-liver oil.

37. *Ecbolics, Oxytocics* (Gr. *ἐκ*, out of, + *βάλλειν*, to throw out; *ὄψις*, quick, + *τόκος*, birth).—These stimulate the muscular fibres of the gravid uterus to contraction, thus causing premature birth or abortion: ergot, cottonroot bark, savine, hydrastis, potassium permanganate, oils of rue, tansy, and pennyroyal.

38. *Aphrodisiacs* (Gr. *Ἀφροδίτη*, Venus, Greek goddess of love, venereal).—These stimulate sexual appetite and power by acting reflexly or directly upon the cerebral or spinal genital centre: damiana, phosphorus, cantharides, tonics, ergot, meat diet, strychnine, indian cannabis, alcohol.

39. *Anaphrodisiacs* (Gr. ἀν, not, + Ἀφροδίτη).—These lessen sexual functions and appetite, by diminishing excitability of the nerves of the genital organs, also by depressing the genital centres in the brain and spine, and by decreasing local circulation: bromides, camphor, opium, tobacco, purgation, venesection, cold baths, ice, vegetable diet, cocaine, belladonna.

40. *Galactagogues* (Gr. γάλα, milk, + ἄγειν, ἀγωρός, to lead, leading forth).—These increase lacteal secretion: pilocarpus, ricinus (leaves locally), thea (internally with alcohol, beer, porter), etc.

#### X. AGENTS ACTING ON THE CUTANEOUS SYSTEM (SKIN).

41. *Irritants, Counter-irritants*.—These when applied to the skin cause vascular excitement; are called counter-irritants when used to produce reflex influence on remote parts: (a) *Rubefacients* (L. *rubere*, to be red, + *facere*, to make)—which produce temporary redness and skin congestion; if left on too long, may cause exudation between the cuticle and true skin (vesicants), or may destroy the tissue, forming a slough (escharotics), or may cause muscular atrophy: mustard, capsicum, mezereum, iodine, menthol, ammonia, arnica, volatile oils (turpentine, cajuput, etc.), hot water, friction; (b) *Vesicants, Epispastics, Blisters* (L. *vesica*, a blister; Gr. ἐπί, upon, + σπᾶν, to draw)—which produce much inflammation of the skin and effusion of serum between the epidermis and derma: cantharides, mezereum, iodine, rhus toxicodendron, glacial acetic acid, volatile oil of mustard, steam, boiling water, ammonia vapor; (c) *Pustulants* (L. *pustulare*, to blister)—which cause pustules, and affect isolated parts of the skin, as orifices of sudoriferous glands: croton oil, tartar emetic, silver nitrate; (d) *Escharotics, Caustics* (Gr. ἐσχάρα, a scab, scar)—which destroy tissue when applied, by abstracting its water, or by combining with the albumin of the skin, or by corrosive deoxidation of the tissues, thus causing a slough: mineral acids, phenol (carbolic acid), chromic acid, lime, potassium and sodium hydroxides, dried alum, silver nitrate, zinc chloride, copper sulphate, corrosive mercuric chloride, mercuric oxide and nitrate, bromine, high heat, electric cautery, boiling water, arsenic trioxide.

42. *Styptics, Hemostatics* (L. *stypticus*, contracting; Gr. αἷμα, blood, + ἰστάναι, στατικό, to stop, stopping).—These arrest hemorrhage; the former being used locally, the latter internally. Some act mechanically, by closing the mouths of the bleeding vessels with a blood-clot; others contract the vessels, thus checking the blood-flow: (1) acids, alum, collodion, ferric chloride and sulphate, silver nitrate, matico, tannin, lead acetate, zinc sulphate, vegetable astringents, cold (locally), electric cautery; (2) ergot, gallic acid, matico, lead acetate, diluted sulphuric acid, hamamelis, oil of turpentine, heat (locally).

43. *Emollients* (L. *emollire*, to soften).—These soften and relax the tissues when applied locally, diminish the tension and pressure on the nerves, dilate the vessels, and protect inflamed surfaces: poultices, fatty



oils, lard, spermaceti, glycerin, petroleum, starch, soap liniment, cacao-butter.

44. *Demulcents* (*L. demulcere*, to soothe).—These are usually mucilaginous or oleaginous, intended for soothing parts to which applied; they are restricted generally to mucous membranes, and emollients to the skin: acacia, cetraria, starch, flaxseed, licorice, gelatin, honey, althæa, egg-white, tragacanth, olive and other bland oils.

45. *Protectives*.—These are mechanical coverings to protect various injured parts from air, water, friction, etc.: collodion, plasters, etc.

V. ARRANGEMENT BY NATURAL AFFINITIES (BOTANICAL).—This system is the one adopted throughout this work. It is of all others the most scientific by which plants may be studied, and, as the official portions of vegetable drugs are but parts of the whole, it seems only natural that the parental source should furnish the basis of classification for these medicinal parts. Every one knows that there are greater similarities and dissimilarities between some plants than between others, and that this likewise applies to animals. Scientists, taking advantage of this fact, have for several centuries been trying to form groups of plants, each to contain only those possessing, in common, certain marks of resemblance, and so naming the same, when possible, to typify the strongest characteristic. Early botanists were content with one point of agreement, but they differed even as to what plant-organ, above all others, should be accepted to furnish this point, hence the basis of a system. Cæsalpinus (1519–1603) selected the fruit, the globular furnishing one class, the flat another, etc. Tournefort (1656–1708) took the flower, restricting himself to the modification and arrangement of the corolla, the cup-shaped being one class, the bell-shaped another, etc. Linnæus (1707–1778) went a step farther, and founded classes and orders upon the position, number, and relative lengths of the stamens and pistils, giving us the Linnæan, artificial, or sexual system of plants. This worked very well until cultivation, climatic differences, etc., changed the number of stamens and pistils. So far, no one had taken into consideration the plant's entirety. It is to John Ray (1628–1705), often called the "father of English natural history," that we owe the conception of a broader and more natural system; but it was Jussieu (1748–1836) who, embodying the grand features of both Ray and Tournefort, laid the permanent foundation of the true natural system which, somewhat modified, has come down to us. The very foundation of this system necessitates the faithful consideration of the similarities in form, structure, growth, habits, functions, thereby involving the idea of "affinity in essential organs." These understood, we may arrange the entire vegetable kingdom into allied groups of a scaling grade, dependent upon their whole make-up, thus placing each family (natural order) genus, and species next to those it most resembles in all respects.

*Families or Natural Orders*.—Of these there are about 280; they are the broader groups, and each comprises plants resembling one another

in some strong particular, which applies to them generally as a class; this characteristic usually is taken from one of the reproductive organs (flowers, fruit, seed), and is so striking as to be noticeable by the inexperienced: Leguminosæ (fruit in legumes), Umbelliferæ (flowers in umbels), Compositæ (flowers compound), Labiatae (corolla 2-lipped), Cupuliferæ (fruit in cupule), Guttiferæ (juice exudes in drops), Coniferæ (fruit in cones), Cruciferæ (petals arranged like a Maltese cross), etc.

*Genus, Genera.*—Of these there are about 10,000; they are more restricted groups, and go to compose the families or natural orders. This name corresponds to the family, surname, or last name of persons, Brown, Smith, Jones; it is a noun, and, like the family (ordinal) name, begins with a capital. Genera also are grouped according to some certain but more restricted characteristic taken from the reproductive organs; hence a genus is a collection of species resembling one another in the structure and general characters of the organs of reproduction, or in reproductive processes, methods of fructification, pollination, etc. Plants of the same genus are expected to be on the same numerical plan, and to have flowers, constituents, and medicinal properties somewhat similar.

*Species, Species.*—Of these there are about 200,000; they are the most restricted permanent groups and make up the various genera. This name corresponds to the baptismal or first name of persons, James, John, William; it is usually an adjective agreeing in case and gender with generic name, and, as such, should begin with a small letter. These are grouped according to some certain but still more restricted characteristics taken usually from the vegetative organs (root, stem, leaves), as color, proportion, shape, surface, duration, division, etc.; hence, species is a succession of individuals which reproduces and perpetuates itself. The last two names, generic and specific, when taken together, constitute the plant's name—i. e., botanical source or origin—and consequently every plant (and animal) is thus always designated.

There are two scientific methods (with their many modifications) of arranging each family (natural order), genus, and species toward its nearest neighbor. Thus we may follow Jussieu's sequence, beginning with the cellular, flowerless, or lowest plant-life (Algae), advancing to those of vascular structure, with apologetic, imperfect, or incomplete floral parts, always having each to follow in the ascending scale, finally reaching those producing as then understood the most perfect, complete, and typical flowers (Ranunculaceæ). De Candolle (1778–1841) greatly innovated this system, but chiefly in reversing the arrangement, placing the most highly organized plants, or flower producers, first in order, and each lower one in a descending succession. This would seem the most unnatural, as the order of development in nature surely suggests evolution from forms more simple to those more complex, and not the converse. In spite of this, however, it has universally been accepted for the past half century, being strongly

indorsed and followed by many of the world's greatest botanists, including Bentley, Trimen, Hanbury, Gray, Balfour, Bentham, Hooker, etc.; and is enunciated best by Bentham and Hooker in their *Genera Plantarum*.

The other plan, being the most rational, has always continued to have supporters, and during the past two decades has been studied systematically and thoroughly, especially in Germany, with more than ordinary zeal and results. Such scholars as Eichler, Engler, Prantl, Thomé, Potonié, Richter, Flückiger, Köhler, Stasburger, Schenck, Schimper, etc., have instituted many changes, and, although beginning with the most primitive plant-life and ending with those bearing most complex flowers (Compositæ), have succeeded in evolving the system in a form much more consistent and in harmony with modern scientific thought and general plant-nature. As such, it is enunciated best by Engler and Prantl in their *Die Natürlichen Pflanzenfamilien*, and by Engler in his *Syllabus der Pflanzenfamilien*, and as this is the sequence that necessarily must come into future favor, it has been thought wise, in the main, to adhere to it in this work, giving thereto the following synopsis :

#### SUB-KINGDOM I. **THALLOPHYT(ES)-A.**

##### CLASS 1. **ALGÆ.**

1. *Gigartinaceæ*.—Distinguished by being parenchymatous plants, growing in fresh or salt water, or moist places, red, purple, or violet hue, less commonly green or blackish; composed of 250 species. *Chondrus*.

##### CLASS 2. **FUNGI.**

2. *Hypocreaceæ*.—Distinguished by rarely containing chlorophyll, saprophytes, parasites, either soft, fibrous, gelatinous, fleshy, leathery, horny, mycelium inconspicuous, often producing a dense homogeneous tissue; composed of 200 species. *Claviceps*.

#### SUB-KINGDOM II. **PTERIDOPHYT(ES)-A.**

##### CLASS 3. **FILICINÆ.**

3. *Polypodiaceæ*.—Distinguished by leaves being fronds, large, spores one kind, in cases (sporangia) on under surface or margin, circinate in veneration, stems usually prostrate, subterranean; composed of 70 genera, 3,000 species. *Dryopteris*.

##### CLASS 4. **LYCOPODINÆ.**

4. *Lycopodiaceæ*.—Distinguished by yellow spores, low, usually moss-like evergreens, stems much branched, elongated, sporangia 1-3-celled, solitary in the axils of leaves, or on their upper surface; composed of 125 species. *Lycopodium*.

SUB-KINGDOM III. **SPERMATOPHYT(ES)-A.**CLASS 5. **GYMNOSPERMÆ.**

5. *Pinaceæ* (*Coniferae*).—Distinguished as resinous, evergreen trees, shrubs, flowers unisexual, no perianth, staminate—catkins, pistillate—scaly aments, becoming cones, sepals naked (2), leaves needle-shaped; composed of 25 genera, 240 species. *Pinus*, *Abies*, *Juniperus*.

CLASS 6. **ANGIOSPERMÆ.**SUB-CLASS 1. **Monocotyledones.**

6. *Graminaceæ*.—Distinguished by glumaceous flowers, paleæ 2 in each, stamens hypogynous, stems hollow, jointed, leaves 2-ranked; composed of 3,500 species. *Zea*, *Saccharum*, *Agropyron*, *Hordeum*.

7. *Palmaceæ*.—Distinguished by plants being unbranched, leaves large, plaited, palmately parallel-veined, in one terminal cluster, perianth double, 3-merous; composed of 129 genera, 1,100 species. *Sabal*.

8. *Araceæ*.—Distinguished by perfect flowers or monœcious, spadix with spathe, no perianth, fruit succulent, leaves veiny; composed of 105 genera, 900 species. *Acorus*.

9. *Melanthaceæ*.—Distinguished by ovary superior, capsules mostly septicidal, with rootstocks, rarely bulbs, perianth 6, stamens 6, seeds appendaged, leaves grass-like, polygamous or diœcious; composed of 36 genera, 140 species. *Veratrum*, *Asagracea*.

10. *Liliaceæ*.—Distinguished by regular, symmetrical flowers, 6's, perianth non-glumaceous, petaloid, hypogynous, ovary 3-celled, anther 2-celled; composed of 125 genera, 1,300 species. *Urginea*, *Aloe*.

11. *Convallariaceæ*.—Distinguished by being erect herbs, fruit—fleshy berry, no tendrils, never with bulbs or corms, flowers solitary, regular, perfect, 6's, ovary superior; composed of 23 genera, 215 species. *Convallaria*, *Colchicum*.

12. *Smilacæ*.—Distinguished by being mostly vines, woody, herbaceous, often prickly stems, leaves net-veined, flowers green, diœcious, perianth 6, stamens 6, fruit globose berry, 1-6-seeded; composed of 3 genera, 200 species. *Smilax*.

13. *Zingiberaceæ*.—Distinguished by creeping rhizomes, calyx and corolla distinct, each 3, leaves stalked, sheathing, ovary inferior, stamens 6; composed of 30 genera, 280 species. *Elettaria*, *Zingiber*.

14. *Orchidaceæ*.—Distinguished by the 1-2 sessile anthers united to pistil, flowers irregular, reptile-shape, perfect, perianth 6 in 2 rows, petaloid; composed of 410 genera, 5,000 species. *Cypripedium*, *Vanilla*.

SUB-CLASS 2. **Dicotyledones.**SERIES I. **Choripetalæ.**

15. *Piperaceæ*.—Distinguished by jointed stems, ovary sincarpic,

1-celled, stigma sessile, 2, 3, 4, fruit fleshy, 1-celled, 1-seeded; composed of 8 genera, 1,060 species. *Piper* (*Cubeba*).

16. *Salicaceæ*.—Distinguished by diœcious flowers, both kinds in catkins, no perianth or only cup-like calyx, stamens 1–30, fruit capsule; composed of 2 genera, 200 species. *Salix*, *Populus*.

17. *Betulaceæ*.—Distinguished by monœcious flowers, no calyx, but instead, have scaly bracts, stamens 2–4, ovary 2-celled; composed of 6 genera, 75 species. *Betula*.

18. *Fagaceæ* (*Cupuliferæ*).—Distinguished by small flowers, monœcious, staminate—aments, pistillate subtended by involucre (united bracts) becoming a bur (cup), petals none, stamens 4–20, perianth 4–8-lobed; composed of 5 genera, 375 species. *Quercus*.

19. *Ulmaceæ*.—Distinguished by fugacious stipules, small flowers, monœcious, diœcious, perfect or polygamous, perianth 3–9-parted, or sepals, petals none, stamens 3–9, ovary 1-celled, superior, samara, drupe or nut; composed of 13 genera, 140 species. *Ulmus*.

20. *Moraceæ*.—Distinguished by having milky juice, small flowers, monœcious, diœcious, calyx 4–5-parted, petals none, stamens 4–5, ovary 1-celled, superior, fruit various; composed of 55 genera, 925 species. *Ficus*, *Humulus*, *Cannabis*.

21. *Santalaceæ*.—Distinguished by calyx 4–5 valvate-lobed, green or petaloid, stamens perigynous, sheathing disk, ovules suspended by funiculus; composed of 26 genera, 250 species. *Santalum*.

22. *Aristolochiaceæ*.—Distinguished by colored, irregular calyx, epigynous stamens, fruit capsule, many-seeded, leaves cordate; composed of 5 genera, 200 species. *Aristolochia*.

23. *Polygonaceæ*.—Distinguished by stems having many swollen joints, ochreate stipules above each, flowers perfect, calyx colored or greenish, ovary superior, 1-celled; composed of 30 genera, 800 species. *Rheum*.

24. *Chenopodiaceæ*.—Distinguished by succulency and flowers being ebracteate, minute, greenish, perfect or unisexual, ovary superior, 1-celled, fruit 1-seeded utricle; composed of 75 genera, 550 species. *Chenopodium*.

25. *Phytolaccaceæ*.—Distinguished from *Chenopodiaceæ* by ovary superior of many carpels in a ring, each with individual style, stamens hypogynous; composed of 22 genera, 85 species. *Phytolacca*.

26. *Myristicaceæ*.—Distinguished by leaves alternate, dotted, leathery, flowers diœcious, regular, calyx 3–4-cleft, filaments 3–12, united, ovary 1-celled, ovule 1, fruit succulent; composed of 5 genera, 100 species. *Myristica*.

✓ 27. *Ranunculaceæ*.—Distinguished by flowers being most complete, organs all distinct, no adhesion nor cohesion, often yellow; composed of 35 genera, 1,050 species. *Hydrastis*, *Cimicifuga*, *Delphinium*, *Aconitum*.

28. *Berberidaceæ*.—Distinguished by the few stamens being in 2–3 whorls and anthers opening by two hinged valves (*Podophyllum*—longitudinal); composed of 20 genera, 105 species. *Berberis*, *Podophyllum*.

29. *Menispermaceæ*.—Distinguished by flowers being diœcious, petals

shorter than sepals, solitary seed moon- or kidney-shaped, woody climbers; composed of 55 genera, 150 species. *Chondrodendron*, *Jateorhiza*.

30. *Lauraceæ*.—Distinguished by polygamous flowers, calyx inferior, petaloid, anthers opened by 2–4 uplifted valves, ovary 1-celled, fruit drupe or berry; composed of 40 genera, 900 species. *Sassafras*, *Cinnamomum*.

31. *Papaveraceæ*.—Distinguished by the 2–3 fugacious sepals and minute embryo near the base of fleshy albumin; composed of 26 genera, 200 species. *Papaver*, *Sanguinaria*.

32. *Cruciferae*.—Distinguished by pungent or acrid juice, cruciform flowers, tetradynamous stamens, and fruit a silique or silicle; composed of 185 genera, 1,500 species. *Sinapis*, *Brassica*.

33. *Hamamelidaceæ*.—Distinguished by ovary being inferior, ovule solitary, pendent from cell apex, fruit capsule, 2-celled; composed of 15 genera, 35 species. *Hamamelis*, *Liquidambar*.

34. *Rosaceæ*.—Distinguished by prickles, warts on woody surface, flowers regular, stamens inserted on calyx tube, perigynous; composed of 65 genera, 1,200 species. *Rubus*, *Rosa*, *Quillaja*, *Hagenia*.

35. *Drupaceæ*.—Distinguished by bark exuding gum, bark and seeds containing hydrocyanic acid, calyx 5-lobed, free from ovary, petals (5), stamens (many) inserted on calyx, ovary 1-celled, 2-ovuled, drupe; composed of 6 genera, 110 species. *Prunus* (*Amygdalus*).

36. *Mimosaceæ*.—Distinguished by ovary several-ovuled, fruit legumes, leaves 2–3-pinnate, flowers small, regular, calyx 3–6-lobed, corolla 3–6, stamens distinct or monadelphous, ovary 1-celled; composed of 30 genera, 1,350 species. *Acacia*.

37. *Cæsalpinaceæ*.—Distinguished by legumes, upper petal enclosed by lateral ones in the bud, leaves compound, stipulate, flowers perfect, monœcious, diœcious, polygamous, 5's; composed of 90 genera, 1,000 species. *Cassia* (*Cathartocarpus*), *Tamarindus*, *Hæmatoxylon*, *Copaiba*.

38. *Krameriaceæ*.—Distinguished by fruit spiny, indehiscent, leaves simple, exstipulate, sepals 4–5, petals 5, smaller than sepals, stamens monadelphous, ovary 1–2-celled, ovules 2, fruit 1-seeded; composed of 1 genus, 15 species. *Krameria*.

39. *Papilionaceæ*.—Distinguished by legumes or loment, upper petal enclosing lateral ones in the bud, leaves compound, stipulate, calyx 4–5-toothed, petals somewhat united (banner, wings, keel), stamens usually 10, pistil 1, superior; composed of 310 genera, 5,000 species. *Toluidifera*, *Astragalus*, *Pterocarpus*, *Glycyrrhiza*, *Cytisus*, *Vouacapoua*, *Physostigma*.

40. *Geraniaceæ*.—Distinguished from Rutaceæ by leaves being non-glandular, punctate, axis of lobed fruit persistent, carpels distinct, indehiscent; composed of 10 genera, 450 species. *Geranium*.

41. *Linaceæ*.—Distinguished by flowers being regular, showy, stamens monadelphous at base, sepals imbricate, ovary 3–5-celled, composed of 4 genera, 150 species. *Linum*.

Leguminosæ.

42. *Erythroxylaceæ*.—Distinguished from *Linacæ* by the shrubby or arboreous habit, and by the drupaceous fruit, calyx 5-lobed, petals 5, stamens 10, hypogynous, ovary superior; composed of 3 genera, 60 species. *Erythroxylon*.

43. *Zygophyllaceæ*.—Distinguished by flowers bearing a fleshy disk, white, red, yellow, sepals 5, free, glandless; composed of 20 genera, 150 species. *Guaiacum* (*Guajacum*).

44. *Rutaceæ*.—Distinguished by leaves being exstipulate, dotted, petals imbricated, ovary sessile, surrounded at base by fleshy, glandular disk, or elevated on gynophore; composed of 110 genera, 880 species. *Xanthoxylum*, *Pilocarpus*, *Barosma*, *Citrus*.

45. *Simarubaceæ*.—Distinguished from *Rutaceæ* by leaves being exstipulate, without glands or dots, disk conspicuous, ovary stalked; composed of 30 genera, 112 species. *Picrasma*, *Quassia*.

46. *Burseraceæ*.—Distinguished by secreting a resinous or gum-resinous juice, leaves compound, dotted, disk and stamens perigynous, ovary superior; composed of 26 genera, 150 species. *Commiphora*.

47. *Polygalaceæ*.—Distinguished by flowers being irregular, papilionaceous, stamens monadelphous, sepals 5, of which 2 inner are wing-like, petaloid; composed of 10 genera, 150 species. *Polygala*.

48. *Euphorbiaceæ*.—Distinguished by milky acrid juice, flowers unisexual, apetalous, fruit tricoccus, 3-6-seeded capsule, radical superior; composed of 210 genera, 4,000 species. *Hevea*, *Croton*, *Ricinus*, *Stillingia*.

49. *Anacardiaceæ*.—Distinguished by milky, acrid, resinous juice, petals and stamens perigynous, disk hypogynous or wanting; composed of 50 genera, 400 species. *Rhus*, *Pistacia*.

50. *Celastraceæ*.—Distinguished from *Rhamnaceæ* by having stamens opposite the sepals, seed arillate, disk large, flat, surrounding ovary; composed of 40 genera, 350 species. *Euonymus*.

51. *Sapindaceæ*.—Distinguished by flowers being unsymmetrical, hypogynous, leaves compound, sepals and petals on a fleshy, glandular disk; composed of 120 genera, 1,000 species. *Paullinia*.

52. *Rhamnaceæ*.—Distinguished by its spiny habit, perigynous stamens, concave petals, non-caducous, valvate sepals, fruit not a berry; composed of 45 genera, 575 species. *Rhamnus*.

53. *Vitaceæ*.—Distinguished as vines climbing by tendrils, petals 4-5, caducous, fruit 1-6-celled berry, nodose joints, flowers greenish, calyx entire or 4-5-toothed, petals 4-5, stamens 4-5, ovary 2-6-celled; composed of 10 genera, 450 species. *Vitis*.

54. *Malvaceæ*.—Distinguished by stamens monadelphous, anthers 1-celled, leaves often downy, palmate-divided; flowers showy, purple, yellow, white; composed of 40 genera, 800 species. *Althæa*, *Gossypium*.

55. *Sterculiaceæ*.—Distinguished by flowers being regular or irregular, petals sometimes absent, filaments usually monadelphous, anthers 2-celled; composed of 49 genera, 730 species. *Theobroma*.

56. *Theaceæ* (*Ternstroemiaceæ*).—Distinguished by sepals distinct, endosperm little or none, leaves alternate, flowers large, solitary, sepals

5, petals 5, hypogynous, ovary 2-several-celled, fruit 2-3-celled, woody capsule; composed of 16 genera, 160 species. *Thea*.

57. *Guttiferæ*.—Distinguished by yielding a resinous juice, stamens distinct, monadelphous or polyadelphous, flowers unisexual or polygamous, leaves coriaceous; composed of 24 genera, 340 species. *Garcinia*.

58. *Thymelæaceæ*.—Distinguished by calyx being petaloid, 4-5 imbricated lobes, stamens perigynous, radical superior, ovary 1-celled, fruit drupe; composed of 37 genera, 425 species. *Daphne*.

59. *Lythraceæ* (*Punicaceæ*).—Distinguished by calyx lobes being valvate, petals wrinkled, leaves exstipulate, stamens perigynous, inserted below the petals; composed of 21 genera, 350 species. *Punica*.

60. *Myrtaceæ*.—Distinguished by numerous stamens, leaves exstipulate, opposite, dotted, with marginal vein, ovary inferior; composed of 76 genera, 2,700 species. *Melaleuca* (*Cajuputi*), *Eugenia*, *Pimenta*, *Eucalyptus*.

61. *Umbelliferæ*.—Distinguished by the 2-celled ovary forming a cremocarp, with oil-tubes, flowers in umbels, stems hollow, ovary inferior, crowned with fleshy disk; composed of 170 genera, 1,600 species. *Fœniculum*, *Pimpinella*, *Carum*, *Coriandrum*, *Conium*, *Ferula*.

## SERIES II. Gamopetalæ.

62. *Pyrolaceæ*.—Distinguished by ovary superior, 4-5-celled, low, mostly evergreen perennials, flowers white or pink, calyx 4-5-lobed, corolla 4-5, stamens 8-10, stigma 5-lobed, fruit dehiscent capsule; composed of 3 genera, 20 species. *Chimaphila*.

63. *Ericaceæ*.—Distinguished by hypogynous corolla and stamens, anthers 2-celled, dehiscing by pores or slits, ovary 2-5-celled, leaves exstipulate, fruit capsule or berry; composed of 55 genera, 1,050 species. *Gaultheria*, *Arctostaphylos*.

64. *Styracææ*.—Distinguished by flowers of 5-10 stamens attached to 5-lobed corolla, anthers 2-celled, calyx coherent with ovary, superior or part inferior, fruit drupe; composed of 7 genera, 75 species. *Styrax*.

65. *Oleaceæ*.—Distinguished by 2 stamens, ovary superior, 2-celled, each with 2 ovules, corolla regular, 4-8-cleft, fruit capsule, berry, or drupe, seed albuminous, oily; composed of 21 genera, 500 species. *Olea*, *Fraxinus*.

66. *Loganiaceæ*.—Distinguished by opposite, entire, stipulate leaves, stamens epipetalous, styles divided as ovary cells number, fruit capsule, drupe, seeds winged; composed of 30 genera, 400 species. *Gelsemium*, *Spigelia*, *Strychnos*.

67. *Gentianaceæ*.—Distinguished by being smooth herbs, leaves entire, glabrous, sessile, calyx and corolla persistent, ovary superior, fruit 2-celled capsule; composed of 65 genera, 600 species. *Gentiana*, *Suertia*.

68. *Apocynaceæ*.—Distinguished by milky juice, from Asclepiadaceæ by stamens being free from style and stigma, anthers contain granular pollen, stigma hour-glass-shaped; composed of 130 genera, 1,050 species. *Apocynum*, *Strophanthus*.



- ✓ 69. *Convolvulaceæ*.—Distinguished by milky juice, from *Solanaceæ* and *Scrophulariaceæ* by twining, trailing habit, alternate leaves, large solitary seeds, crumpled embryo, corolla 5's, plaited; composed of 40 genera, 900 species. *Exogonium*, *Convolvulus*.
70. *Hydrophyllaceæ*.—Distinguished by watery, insipid juice, flowers scorpioid, 5's, stamens borne on corolla base, styles 2, fruit capsule; composed of 17 genera, 160 species. *Eriodictyon*.
- ✓ 71. *Labiataæ*.—Distinguished by square stems, corolla bilabiate, stamens 4, didynamous, ovary 4-lobed, leaves aromatic, stigma bifid, fruit achenes; composed of 160 genera, 3,000 species. *Scutellaria*, *Marrubium*, *Salvia*, *Hedeoma*, *Thymus*, *Mentha*, *Lavandula*, *Rosmarinus*.
- ✓ 72. *Solanaceæ*.—Distinguished by colorless juice, flowers with plicate border, isomerous, ovules many, fruit capsule or berry, ovary superior; composed of 70 genera, 1,600 species. *Capsicum*, *Atropa*, *Scopola*, *Hyoscyamus*, *Datura*.
73. *Scrophulariaceæ*.—Distinguished by 2-celled ovary, numerous seeds, fleshy albumin, calyx 5-lobed, corolla irregular, 2-lipped, stamens 4, didynamous, ovary sessile, 2-celled, fruit capsule or berry; composed of 165 genera, 2,500 species. *Veronica*, *Digitalis*.
74. *Rubiaceæ*.—Distinguished by regular, epigynous corolla, valvate lobes, salver, rotate, or funnel-shaped, stamens on corolla-tube, epipetalous, ovary crowned with an epigynous disk, fruit capsule or fleshy nuts; composed of 355 genera, 5,500 species. *Coffea*, *Cephaelis*, *Cinchona*, *Ourouparia*.
- ✓ 75. *Cuprifoliaceæ*.—Distinguished by gamopetalous corolla, leaves opposite, exstipulate, stamens on corolla-tube, ovary inferior, fruit berry or drupe; composed of 10 genera, 260 species. *Viburnum*.
- ✓ 76. *Valerianaceæ*.—Distinguished by corolla being epigynous, anthers free, seed exalbuminous, leaves exstipulate, ovary inferior, 3-celled, 2 empty; composed of 9 genera, 275 species. *Valeriana*.
- ✓ 77. *Cucurbitaceæ*.—Distinguished by stems being succulent, prostrate or climbing, with tendrils, flowers unisexual, leaves and stem scabrous, fruit pulpy; composed of 90 genera, 650 species. *Cucurbita*, *Citrullus*, *Ecballium*.
78. *Campanulaceæ*.—Distinguished by endosperm present, fleshy, usually milky juice, flowers perfect, calyx 5-lobed, gamopetalous, stamens 5, ovary 2-5-celled, fruit capsule or berry, seeds many; composed of 60 genera, 1,500 species. *Lobelia*.
79. *Cichoriaceæ*.—Distinguished by flowers all expanded into rays (ligulate), juice milky, calyx-tube adnate to ovary, gamopetalous, 5-toothed, anthers connate, ovary 5-celled, ovule 1, fruit achene; composed of 65 genera, 1,400 species. *Taraxacum*, *Lactuca*.
- ✓ 80. *Compositæ*.—Distinguished by compound flowers, watery or resinous (rarely milky) sap, calyx-tube adnate to ovary, corolla 5-lobed, stamens 5, borne on corolla, anthers syngenesious, ovary 5-celled, ovule 1, fruit achene; composed of 760 genera, 10,000 species. *Eupatorium*, *Grindelia*, *Erigeron*, *Calendula*, *Anthemis*, *Matricaria*, *Anacyclus*, *Artemisia*, *Arnica*, *Arctium*.

# PART I.

## ORGANIC DRUGS FROM THE VEGETABLE KINGDOM.

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### SUB-KINGDOM I. THALLOPHYTES-A.

Cellular cryptogams, composed of one or many cells, with no differentiation of root, stem, or leaves, the thallus being without true woody fibres and vessels.

#### CLASS 1. ALGÆ.

##### 1. GIGARTINACEÆ. Red Seaweed Family.

**Gig-ar-ti-na'se-e.** L. *Gigartin-a* + aceæ, fr. Gr. γίγαντρον, a grape-stone—i. e., from the resemblance of the capsules (cystocarps), which are oval, appearing as little elevated or stalked tubercles on the flat portions of the frond (thallus). Composed of many fleshy, gelatinous algæ, red, purple, or violet, with thalli flat and somewhat forked, but without distinction of nodes and branches; form and structure varying, while reproductive processes are complex; auxiliary cells and carpo-gonia separate, but usually in groups; universal; nutritious, demulcent, alterative.

Genus: 1. *Chondrus*.

#### CHONDRUS. CHONDRUS.

**Chondrus**  
**crispus**, (Linné) Lyngbye. } The dried plant.

*Habitat.* Atlantic Ocean, New England, Irish Coast.

*Syn.* Irish moss, Carragheen, Carrageen (Moss), Pearl Moss, Salt Rock Moss, Fucus Crispus; Fr. Carragaheen, Mousse (Marine) perlée; Ger. Carrageen, Irländisches Moos, Perl Moos, Knorpeltang.

**Chon'drus.** L. fr. Gr. χόνδρος, cartilage, gristle—i. e., fronds are cartilaginous.

**Cris'pus.** L. curled, crumpled—i. e., its physical appearance.

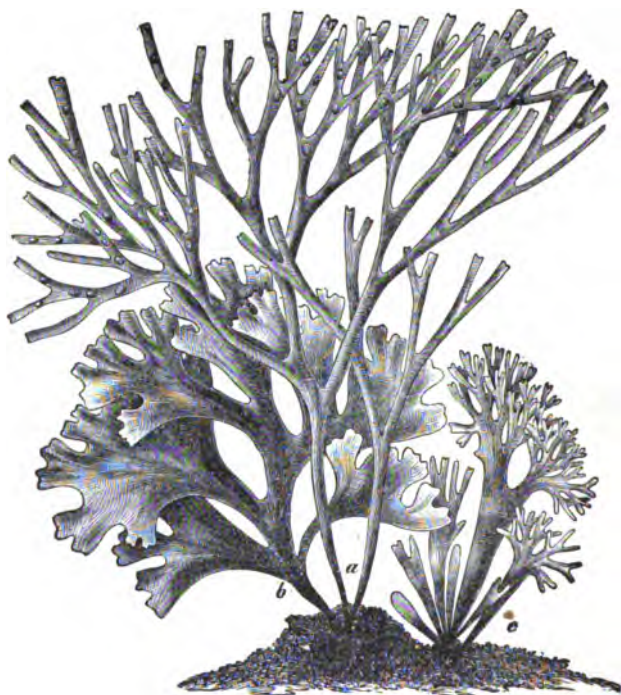
**PLANT.**—Grows on submerged rocks being attached by a small disk; when fresh, frond 15–30 Cm. (6–12') long, more or less greenish but purplish upon drying unless bleached, and consists of a slender, somewhat flattened base one-half the length of entire frond, which after repeated forking terminates in several palmate emarginate or 2-lobed segments; usually in light yellow or yellowish-white matted masses. less than 15 Cm. (6') long, translucent, sometimes with fruit bodies

imbedded near apex of segments, cartilaginous, elastic; odor seaweed-like; taste mucilaginous, saline. *Test*: 1. 1 part boiled 10 minutes with 30 parts water, yields a solution which gelatinizes on cooling, and is not colored blue by iodine T. S. *Solvent*: water. *Dose*, 5j–2 (4–8 Gm.).

**ADULTERATIONS.**—Allied plants, especially *Gigartina mamillosa*, *G. acicularis* and *G. pistillata*, which resemble the official very closely.

**Commercial.**—The plant is known commonly as seaweed or bladderwrack, and although the spring collection is superior—that of summer often being attacked by black mildew, yet most is collected from June

FIG. 1.



*Chondrus crispus*: a, narrow form, with fruit; b, broad form; c, small form.

to August, on the coasts of Ireland and Massachusetts by boatmen tearing it from rocks 3–6 M. (10–20°) under water with rakes, hooks and tongs, or it is taken simply from the beach, where storms and tides leave it. In either event it is then washed in seawater and spread high upon the shore for one or more weeks, in order that it may become partly bleached by the sun and dew. At Scituate, Mass., it is now placed into hogsheds, and these are rolled in marshes, thereby saturating the product with seawater, always avoiding fresh water. After this it is again spread out, and this dual treatment may be repeated several times until the proper yellowish-white color is obtained; finally it is dried in barns and packed into barrels (100 pounds; 45 Kg.).

**GIGARTINACEÆ.**

**CONSTITUENTS.**—Mucilage 55–90 p. c., Minerals 14 p. c., albuminoids 9 p. c., water 18 p. c., cellulose 2 p. c., ash 8–15 p. c.

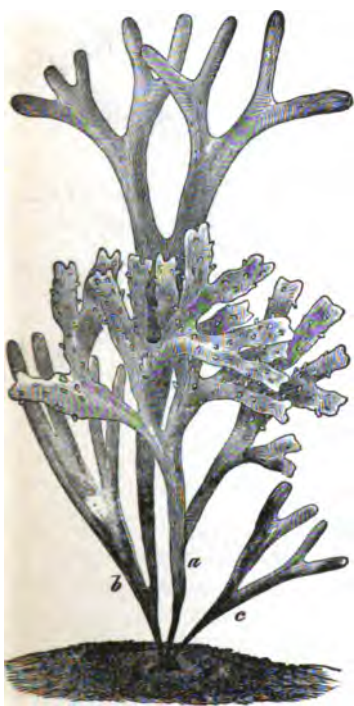
**Mucilage.**—A kind of pectin called carrageenin, 9 p. c. of which is soluble in cold, nearly all in hot water; it differs from gum by alcohol not precipitating the aqueous solution, from starch by not turning blue with iodine, from pectin by not precipitating with lead acetate, and yielding no mucic acid with nitric acid; with diluted sulphuric acid yields galactose (sugar); has only slight adhesive properties, but sometimes is substituted in its three forms, *white*, *yellowish*, *yellow*, for acacia, under the name of “imitation gum arabic.”

FIG. 3.



*Fucus vesiculosus*: fructing branch,  
natural size.

FIG. 2.



*Gigartina mamillosa*: a, narrow form, with  
fruit; b, large form; c, small form.

**Minerals.**—These are the chlorides, sulphates, phosphates (traces of iodides and bromides) of sodium, potassium, calcium, and magnesium.

**PREPARATIONS.**—(Unoff.) *Decoction*, 5 p. c. (water or milk), dose, ʒj–2 (30–60 Cc.). *Mucilage*, 3 p. c., mostly as an emulsifier. *Gelatin*. Any of these may be sweetened and flavored with lemon juice, etc., to one's pleasure. By macerating 10 minutes in cold water, throwing

liquid away, then boiling with fresh water for 15 minutes, we get a solution free from any unpleasant flavor of saline or other foreign substances.

**PROPERTIES.**—Demulcent, nutrient, dietetic.

**USES.**—Bronchitis, dysentery, diarrhoea, kidney and bladder affections, scrofula. Sheet gelatin is substituted for poultices by wrapping in flannel and moistening; may also be used as a diet wherever tapioca, sago, or barley is desired.

*Allied Plants:*

1. *Gigarti'na mamillo'sa*.—The dried plant, official 1880–1900; Atlantic Ocean. Plant resembles *Chondrus crispus* very closely, but has oval spore vessels or capsules raised upon a short stalk, and its frond or thallus is channeled slightly towards the base; *G. acicula'ris* and *G. pistilla'ta* also have similar appearance and properties.

2. *Fu'cus vesiculo'sus*, *Bladder-wrack*.—Atlantic Ocean. Grows on muddy rocks and often floats to the shore; it is 1 M. (40') long, 15 Mm. ( $\frac{3}{8}$ ') broad, flattened, branched, with a midrib. Air vessels in pairs, blackish, odor seaweed-like, taste mucilaginous, saline. *Fucus nodo'sus* is narrow, without midrib, air vessels single, otherwise similar; contains organic matter (mainly mucilage with little mannite, fat, etc.) 62 p. c., volatile oil (trace), moisture 22 p. c., ash 25 p. c.—chlorides, bromides, iodides, phosphates, sulphates (sodium, potassium). Alterative, in obesity. Dose, ʒij (8 Gm.), in decoction.

3. *Agar-agar* (*Eucheu'ma spino'sum*, *E. gelat'inum*).—Indian Ocean. Chinese or Japanese gelatin (isinglass) is extracted from these by hot water and dried; it is in yellowish-white shreds, sticks, cakes, sheets, and consists of gelose or pararabin, being used chiefly as culture medium for micro-organisms.

4. *Dulse* (*Halyme'nia* (*Fucus*) *palma'tus* and *H. ed'ulis*).—Atlantic and Mediterranean coasts. Blood-red—when dry dark purple, fronds flat.

5. *Ceylon Moss*.—Indian Ocean. Mostly *Sphaerococ'cus lichenoi'des*, 10 Cm. (4') long, 1.5 Mm. ( $\frac{1}{16}$ ') thick, cylindrical, forked; reddish—when dry whitish, brittle.

6. *Corsican Moss*.—Mediterranean. A mixture of 20–30 different Algae species. Mainly *Sphaerococcus* (*Fucus*) genus; these are yellowish-brown.

## CLASS 2. FUNGI.

### 2. HYPOCREACEÆ. Flesh-consuming Family.

Hy-po-cre-a'se-e. L. fr. Gr. ὑπο, under, through, by, + κρέας, flesh—i. e., some of the species live upon meat (caterpillars and other insects). Exist mostly upon dead organic matter, sometimes upon living plants and insects; rarely with chlorophyll, mycelium inconspicuous, frequently producing a dense homogeneous tissue; ascocarps complex and either open from the first or at a later period; conidium formation occurs in many ways both from the mycelium and stoma; temperate climates; hæmostatic, ecboic, poisonous.

Genus: 1. *Claviceps*.

## HYPOCREACEÆ.

## ERGOTA. ERGOT.

**Claviceps purpurea**, (Fries) Tulasne. } The sclerotium, replacing the grain of rye,  
*Secale cereale*.

**Habitat.** Eastern countries, Russia. Cultivated in Spain, Germany, France.

**Syn.** Ergot of Rye, Smut of Rye, Spurred or Cockspur Rye, Mother of Rye, Hornseed, *Secale Clavatum*, *Mater Secalis*, *Clavus Secalinus*; Fr. Ergot de Seigle, Seigle Ergoté (noir), Blé Cornu; Ger. *Secale cornutum*, Mutterkorn, Kornmutter, Zapfen- or Hunger-korn.

**Er-go'ta.** L. fr. Fr. *ergot*, *argot*, a spur—i. e., its spur shape.

**Clav'i-ceps.** L. *clava*, a club—i. e., shape of the mycelium or sclerotium.

**Pur-pu're-a.** L. *purpureus*, purple colored—i. e., the purple claviceps—color of the sclerotium.

**Scle-ro'ti-um.** L. fr. Gr. *σκληρός*, hard—i. e., a hard body formed by certain fungi.

**Se-ca'le.** L. *secare*, to cut, or Celtic, *sega*, a sickle—i. e., grain curved like a sickle, or the grain has to be cut down.

**Ce're-al-e.** L. *cerealis*, cultivated grain.

**PLANT.**—Rye is to Russia what corn is to America, its bread approximating nearer that of wheat than any other grain. It has a culm 1.5–2 M. (5–6°) high; leaves .25–.5 M. (10–20') long, rough on upper side; spike 10–15 Cm. (4–6') long, 2-sided, spikelet 2-flowered; grain or seed oblong, grooved on upper side, hairy at summit, brownish; flowers in June; fruits in July. **SCLEROTIUM** (ergot).—The origin of this is the biennial thallophyte (fungus) *Claviceps purpurea*, parasitic during moist seasons on the ovary of grains, grasses, *Carex*, and *Cyperus* species, etc. It has 3 stages of development:

1. **Mycelial:** When rye blooms, a few ovaries in some of the heads are observed to be covered with a sweet, yellow mucus—*honey-dew of rye*, which having a disagreeable odor repels bees, but attracts ants, beetles, and flies—the once supposed cause of the diseased grain, but which are known now to aid only in its dissemination and thereby the spreading of the disease. The filamentous cells (hyphæ) that collectively form the mycelium spread over the lower portion of the ovary, causing the decomposition of ovarian tissue, the production of honey-dew (sugar), and innumerable reproductive bodies (conidia) imbedded therein.

2. **Sclerotial:** While this conidial formation is at its height, the mycelium ceases its superficial growth, presses into the ovary, and begins to form a denser tissue at its base and central portion, and growing upward, ruptures it and develops into a dark purple, horn-

FIG. 4.



Ergotized rye.

like body, sclerotium, or official ergot—the dormant or resting form of the fungus.

3. *Thallus*: This does not take place until the following spring, when ergot sprouts in many heads (stromata) by which the oil and other constituents are consumed, thus leaving the sclerotium shriveled and worthless. Upon the head's surface have formed spherical-topped excrescences, size of a small pin's head; these contain the orifices of flask-shaped cavities or conceptacles (perithecia) from the base of which many cells or spore-sacs (asci) arise, each containing 8 filiform spores. These spores are formed about the time rye flowers, and the two (spores and flowers) acting together develop again the sphacelia or sclerotium. Hence it is necessary always to use the fresh ergot in medicine—*i. e.*, at the end of the second stage, before the third stage takes place.

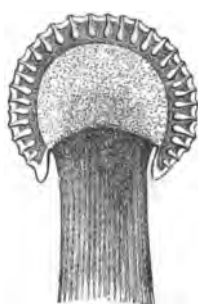
Ergot is somewhat fusiform, obtusely triangular, usually curved, 1.5–3 Cm. ( $\frac{3}{8}$ –1 $\frac{1}{2}$ ') long, 3 Mm. ( $\frac{1}{8}$ ') thick, purplish-black, longitudinally furrowed on each side, more conspicuously on the concave side, fracture short, pinkish or reddish-white; odor peculiar, heavy, increased by trituration with potassium hydroxide T. S.; taste oily, disagreeable.

FIG. 5.



Ergot, with fruit heads.

FIG. 6.



Longitudinal section of fruiting head, showing conceptacles.

FIG. 7.



Ergota.

Should be moderately dried and not exposed to a damp atmosphere; it is unfit for use when kept longer than one year. *Solvent*: diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

*Commercial*.—Too much drying injures ergot, while too little allows it to become mouldy, therefore great care must be exercised in the process; unless very dry and kept in well-stoppered bottles the fixed oil soon becomes rancid, and a mite will oftentimes attack it, in either case rendering the product worthless. In order to prevent largely this deterioration the fixed oil may be extracted with ether or benzin, and the ergot then dried, or to the closed container there may be added from time to time a few drops of chloroform, or suspended therein a tube of potassium sulphate saturated with formaldehyde, or kept over unslaked lime, or coated with ethereal solution of tolu, or the powdered drug may be mixed with benzoin (5 p. c.); in any event it is only the long preservation of the sclerotium entire that should be depended upon. Ergot

**HYPOCREACEÆ.**

that breaks with a sharp snap, devoid of pinkish fracture, hard, brittle between the teeth, odorless and tasteless, should be rejected. We have three important varieties: 1. *Spanish*—largest, finest-looking, highest-priced, bluest. 2. *Russian*—reddish-purple, considered most active. 3. *German*—reddish-purple.

**CONSTITUENTS.**—Cornutine (ecboline) .19–.35 p. c., Ergotine (ergotinine) .04 p. c., Fixed oil 30 p. c., Sphacelic acid, Sclerotic (sclerotinic, ergotic, ergotinic) acid, mycose, proteids, cholesterin, tannin, ash 3 p. c. (phosphates).

**Cornutine.**—(Keller). Alkaloid, soluble in alcohol, chloroform, in ether before crystallization, less so in crystalline form, insoluble in water, petroleum ether, precipitated from acid solutions by alkalis, tannin, bromine water, Mayer's reagent; with sulphuric acid get violet-blue. This is claimed to be the active ingredient in picrosclerotin (Dragendorff), ergotinine (Tauret), and cornutine (Kobert); it is the chief active constituent of the alcoholic extract, which also contains sphacelic acid. The aqueous extract contains chiefly ergotic acid and sphacelates. Bon-jean's ergotin is the aqueous extract from which scleromucin is precipitated by alcohol, then filtered and evaporated; yield 8–12 p. c.—value due to sclerotic acid. Dose (cornutine), gr.  $\frac{1}{20}$ – $\frac{1}{6}$  (.003–.01 Gm.).

**Ergotine.**—Yellowish amorphous powder, fluorescent in alcohol or ether, but red, violet, and blue with sulphuric acid; harmless. Dose, gr.  $\frac{1}{30}$ – $\frac{1}{10}$  (.002–.006 Gm.).

Dragendorff has isolated the following: 1. Sclerotic (sclerotinic, ergotic, ergotinic) acid 4.5 p. c., very active and used hypodermically. 2. Scleromucin 2–3 p. c., mucilaginous, ecbolic, precipitated by alcohol when added to aqueous extract of the drug. 3. Sclererythrin .01 p. c., red coloring-matter resembling madder, soluble in alcohol, ether, alkalis. 4. Scleriodin .1 p. c., bluish-black powder, soluble in alkalis or sulphuric acid with violet color. 5. Fuscosclerotinic acid. 6. Picrosclerotine, very poisonous. 7. Sclerocrystallin,  $C_7H_7O_3$ . 8. Scleroxanthin,  $C_7H_7O_3 + H_2O$ , crystalline, soluble in ether; the last 2 inert.

Kobert claims for ergot only 3 constituents: Ergotic acid, sphacelinic acid (sphacelotoxin), cornutine. Jakoby has isolated sphacelotoxin, secalintoxin (sphacelotoxin and secalin), chrysotoxin, ergochrysin, the first possessing best and longest the ergot properties, the last being inactive. Meulenhoff concludes: activity to depend upon sphacelinic acid (insoluble in water), and a body not present in all sorts of ergot, having spasmodic action; ergotinine to have moderate activity and to be only slightly changed by storage; ecboline and ergotine not to be distinct bases, and cornutine to be a decomposition-product of ergotinine by the action of acids; ergotinic acid to be gum or sugar.

None of the constituents represents the entire activities of the drug, the nearest approach being in cornutine and sphacelic acid taken together; nearly all of them are of a changeable nature, amorphous, resembling gelatin, being difficult, therefore, to isolate and purify.

**PREPARATIONS.**—1. *Extractum Ergotæ*. Extract of Ergot. (Syn., Br. Ergotinum, Ergotin, Extractum Hæmostaticum; Fr. Extrait



d'Ergot de Seigle; Ger. Extractum Secalis cornuti, Mutterkorn-extrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., evaporate to 25 Gm., add water 25 Cc., stir; to filtrate add diluted hydrochloric acid 5 Cc., set aside 24 hours, filter, wash filter with water, add washings to filtrate and to this gradually monohydrated sodium carbonate .85 Gm., evaporate to 15 Gm., add glycerin 1.25 Gm., evaporate to 12.5 Gm. Dose, gr. 2–10 (.13–.6 Gm.).

2. *Fluidextractum Ergotæ*. Fluidextract of Ergot. (Syn., Extractum Ergotæ Fluidum, U. S. P. 1890; Br. Extractum Ergotæ Liquidum; Fr. Extrait liquide de Seigle ergoté; Ger. Extractum Secalis cornuti fluidum, Mutterkorn Fluidextrakt, Flüssiges Mutterkorn-extrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol 98 Cc. + acetic acid 2, finishing with diluted alcohol q. s., evaporate to 100 Cc. Dose, Mxv–60 (1–4 Cc.).

Prep.: 1. *Vinum Ergotæ*. Wine of Ergot. (Syn., Fr. Vin de Seigle ergoté; Ger. Mutterkornwein.)

*Manufacture*: Mix fluidextract of ergot 20 Cc., alcohol 5, white wine 75, set aside 2 days, filter in a well-covered funnel. Dose, ʒj–3 (4–12 Cc.).

*Unoff. Preps.*: *Infusion* (Br.), 5 p. c., dose, ʒj–2 (30–60 Cc.). *Tincture*, 15 p. c. *Tinctura Ergotæ Ammoniata* (Br.), 25 p. c., dose, ʒss–1 (2–4 Cc.). Ergotin, dose, hypodermically, gr.  $\frac{1}{4}$ –5 (.016–.3 Gm.). Sclerotic acid, dose, gr.  $\frac{1}{10}$ – $\frac{3}{4}$  (.006–.048 Gm.).

PROPERTIES.—Emmenagogue, ecbotic, parturient, astringent, hæmostatic, excitomotor, poisonous. Contracts all unstriated (involuntary) muscle, especially uterus and intestine, thereby expelling their contents; the action upon the uterus is both centrally (cornutine) and peripherally (sclerotic acid). Depresses heart muscle, hence slows pulse, contracts arterioles (hæmostatic), thus increasing arterial pressure; diminishes sweat, saliva, milk, urine. In large doses gastrointestinal irritant, causes nausea, vomiting, colic, thirst, purging, convulsions, “acute ergotism,” or by many small doses may have “chronic ergotism”; this last may be in two forms: 1. Convulsive, causing tetanoid spasms of the flexors, respiratory muscles, death by asphyxia. 2. Gangrenous, causing cold, numb limbs, loss of sensibility, gangrene of lower extremities, buttocks, etc., epileptic convulsions, coma, death.

USES.—In labor to increase the power and duration of uterine contractions; these are continuous while natural labor-pains are intermittent, hence ergot is dangerous in thoughtless hands. Should never be used until after head is born, when it simply promotes firm, uterine contraction; it is still wiser to withhold it until after birth, to prevent post-partum hemorrhage and aid womb contraction (fluidextract ʒj (4 Cc.) by mouth or, better, hypodermically). Used also in chronic metritis, dysmenorrhœa, menorrhagia, fibroids, polypi, plethoric amenorrhœa, atonic spermatorrhœa, atonic arterial hemorrhage (males and

**HYPOCREACEÆ.**

females), spinal congestions, splenic enlargement, lax sphincters, incontinence of urine, aneurisms, diabetes. Externally to hemorrhoids.

For hypodermic injection—deprive solid extract of all alcohol, dissolve in water, and introduce near seat of trouble; results here much better than by mouth; should have bladder and bowels freely open. The ergot formed on grasses is often sufficient to cause grazing animals to abort, and flour made of grain containing much of it will also sometimes act medicinally.

*Poisoning*: Have gastric disturbance, vomiting, diarrhoea, burning pain in feet, tingling in fingers, cramps in extremities, dilated pupils, cold surface, dizziness, small and feeble pulse, convulsions. Evacuate stomach (pump, emetics, purgatives), use tannic acid, stimulants, amyl nitrite (inhalation), strychnine, digitalis, friction, hot baths.

*Incompatibles*: Cardiac and motor depressants (aconite, veratrum, lobelia, etc.), caustic alkalies, metallic salts.

*Synergists*: Digitalis, belladonna (circulation), strychnine (nerves), ustilago, gossypium, hydrastine, emmenagogues.

*Allied Plants*:

1. *Ustilago Maydis*, *Corn Smut*.—The fungus growth upon *Zea Mays*, official 1880–1890. United States, etc. The fungus is abundant upon stem, grains, and tassel; in irregular, globose masses 10–15 Cm. (4–6') broad, consisting of a blackish gelatinous membrane enclosing many blackish, globular, nodular spores; odor and taste disagreeable. Should be kept dry and not longer than one year; contains fixed oil 2.5 p. c., sclerotic acid, crystalline principle (ustilagine) and alkaloid (secaline), volatile base, sugar, mucilage, ash 5 p. c. Used as emmenagogue, parturient, increases uterine pains during labor, like ergot. Dose, gr. 15–30 (1–2 Gm.).

2. *Saccharomyces (Torula) cerevisiæ*, *Fermentum (Yeast)*.—A peculiar insoluble product of the fermentation of malt liquors produced by this fungus, official 1820–1840, 1860–1880. Yeast plant is unicellular, multiplies by budding, being produced during alcoholic fermentation of saccharine fluid, in 2 forms: 1. Top or surface yeast, most active, semi-fluid, frothy mass, odorous, cellular, fermenting in 3 or 4 days at 15–20° C. (59–68° F.). 2. Bottom or sediment yeast, works at 6–8° C. (43–46° F.), much slower, reproduces by isolated spores. Liquid yeast becomes hard, dry (yeast cake), retaining vitality a long time; contains enzymes or ferments—zymase, invertase, diastase, maltase, and yields upon analysis C 49.9 p. c., H 6.6 p. c., N 12.1 p. c., O 31.4 p. c., insoluble in alcohol, water, ceases to vegetate below 5° C. (41° F.), but will stand –60° C. (–76° F.) without being killed. Used as tonic, stimulant laxative, antiseptic poultices, for typhoid, diabetes, diarrhoea, scurvy, diphtheria, sores, bruises. Dose, ʒj–2 (30–60 Gm.).

3. *Polyporus (Boletus) fomentarius*, *Agaric of the Oak (Touch Wood)*.—The fungus, official 1830–1840. Europe, on *Quercus* and

*Fagus* species. It is formed by an additional layer of fibres each year ; is collected Aug.-Sept., and resembles the horse's hoof, being 15-25 Cm. (6-10') wide. When young is soft, velvety, but becomes hard and ligneous ; when deprived of outside ligneous portion, brownish above and yellowish-white beneath, porous, fibrous, tough, inodorous, tasteless ; when for use is deprived of harder rind, sliced, boiled in lye, washed, beaten until soft and pliable, then absorbs twice its weight of water ; contains extractive, resin, nitrogenous matter, KCl, CaSO<sub>4</sub> ; also has Fe, Ca, Mg, phosphate. Used locally with pressure to stop hemorrhage. Agaric steeped in nitre solution yields spunk under.

*Agaricus* (*Agaricinum*), C<sub>16</sub>H<sub>30</sub>O<sub>5</sub> + H<sub>2</sub>O, is from *Polyp'orus officinalis* ; occurs in white crystals, sweet at first then bitter, soluble in alcohol. Antihydrotic ; night-sweats of phthisis, sweating from coal-tar products and salicylates. Dose, gr.  $\frac{1}{2}$ -2 (.03-.13 Gm.). Agaricin contains agaric acid, which is the active and better principle to use.

4. *Agar'icus musca'rius* (*Amani'ta musca'ria*), *Fly Fungus* (*Agaric*). —N. Europe, Russia. This mushroom grows in the autumn mainly, under pine trees ; stalk is white, tuberous at base, 7.5-15 Cm. (3-6') high, 1.8 Cm. ( $\frac{3}{4}$ ') thick. Cup (pileus) 10-15 Cm. (4-6') broad, orange-red ; contains chiefly *muscarine* (*muscarina*), C<sub>8</sub>H<sub>15</sub>NO<sub>3</sub>, a colorless, odorless, crystalline, deliquescent alkaloid, yielding deliquescent salts (nitrate, sulphate) ; all usually occur as brown, syrupy liquids, soluble in water, alcohol ; resembles Calabar bean in action ; antihy-

FIG. 8.

*Cetraria islandica* : ap, apothecium.

drotic, antispasmodic, myotic. Reduces force and frequency of pulse, contracts muscles of intestines and bladder, increases abdominal secretions, causes dyspnoea, paralysis, death. Given for intestinal torpor,

**POLYPODIACEÆ.**

duodenal catarrh, diabetes, antidote to atropine, to replace eserine. Dose (muscarine), gr.  $\frac{1}{80}$ — $\frac{1}{15}$  (.002–.004 Gm.).

5. *Cetra'ria islan'dica*, *Iceland Moss*.—Parmeliaceæ. The dried plant, official 1840–1900. N. hemisphere (N. America, etc.). Thallus 5–10 Cm. (2–4') long, foliaceous, fringed, and channeled lobes, brownish above, whitish beneath, apothecia (fruits) brown, flattish, brittle, inodorous; taste mucilaginous, bitter; contains lichenin (starch) and isolichenin (lichenoid) 30–70 p. c., the former predominating, cetrarin (bitter principle, splitting into cetraric acid, lichen-stearic acid and thallaric acid) 2–3 p. c., sugar 3.6 p. c., gum 3.7 p. c., fumaric (lichenic), tartaric and oxalic acids, ash 2 p. c. Demulcent (starch), tonic (cetrarin), nutritive; chronic catarrhs, pulmonary affections (bronchitis, consumption), chronic diarrhoea, dysentery; bread, instead of acacia. Dose, 5ss–1 (2–4 Gm.); decoction, 5 p. c., 3j–4 (30–120 Cc.).

6. *Lecano'ra tarta'rea*, *Lacmus* (*Litmus*).—Holland. This is a blue pigment obtained from this and other lichens by powdering, mixing with potassium carbonate, water, and stale urine (or other ammoniacal liquid), then exposing to the air for fermentation. The liquid turns gradually red, purple, and blue, when it is mixed with enough chalk to be formed into 12–25 Mm. ( $\frac{1}{2}$ –1') rectangular cakes—requires 6 weeks; chiefly produced in Holland. By slightly different processes on the same lichens we obtain the allied pigments, orchil and cudbear. Litmus is used as an indicator to determine the acidity or alkalinity of urine and other animal fluids—acids turning it red, alkalies blue; orchil is a deep purple, pasty mass, used as a dye; cudbear is a purplish-red powder, used as a dye and to color various medicinal preparations.

**SUB-KINGDOM II. PTERIDOPHYT(ES)-A.**

Vascular cryptogams (ferns), mostly terrestrial; stems, roots, leaves, woody fibres, and vessels well developed, spores go into flat or irregular prothallia bearing antheridia and archegonia.

**CLASS 3. FILICINÆ.****3. POLYPODIACEÆ. Fern Family.**

Pol-i-po-di-a'se-e. L. *Polypodi-um* + aceæ, fr. Gr. *πολύς*, many, + *πούς*, *ποδός*, foot—many feet, rays—i. e., from the branched rootstocks of some species. Includes nine-tenths of our ferns, being the typical family. Herbaceous with a permanent stem, which is usually prostrate or subterranean. Fronds large, simple, pinnate, pinnatifid or decom-pound, coiled in vernation; numerous sporangia, on the underside or margins, in clusters (sori). Sori with or without membranaceous covering (indusium), prothallium green; universal, bitter, astringent, anthelmintic, mucilage, tonic.

Genus: 1. *Dryopteris*.

## ASPIDIUM. ASPIDIUM.

**Dryopteris** { **Filix-mas**, (Linné) Schott, } The dried rhizome.  
                   { **marginalis**, (Linné) Gray. }

**Habitat.** 1. N. America, N. Asia, Europe, N. Africa. (Canada, westward to Rocky Mountains, Mexico, S. America, Andes, Himalaya Mountains, Polynesian Islands.) 2. N. America, southward to N. Carolina; mountains.

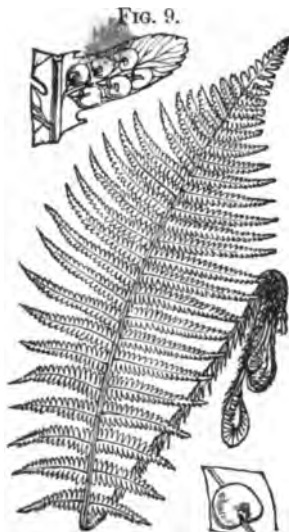
**Syn.** Male Fern, Male Shield Fern, Bear's Paw Root, Sweet Brake, Knotty Brake, Shield Root; Br. *Filix mas*, *Radix Filicis maris*; Fr. *Fougère mâle*; Ger. *Rhizoma Filicis*, *Farnwurz*, *Wurmfarn*, *Wald-farn*, *Johanniswurz*.

**Dry-op'te-ris.** L. fr. Gr. *δρυοπτερίς* = *δρύς*, of the oak, growing among trees, in thickets, + *πτερίς*, a feather, wing or fern—i. e., their favored place of growth.

**Filix-mas'.** L. *filix*, a fern, fr. Gr. *πτερίς*, fern, frond, etc., + *mas*, male—i. e., referring to its asexual fructification.

**Mar-gi-na'lis.** L. *margo*, *marginis*, margin—i. e., the fruit dots are near the edge of the frond.

**As-pid'i-um.** L. fr. Gr. *ασπίδιον*, a little shield—i. e., shape of the indusium.



*Dryopteris Filix-mas.*

**PLANTS.**—Perennials; fronds .3–1 M. (1–3°) high or long, bipinnate, pinnae lanceolate, circular fruit dots situated on the veins, in the first species near the midrib, in the second near the margin, covered by a heart-shaped indusium. **RHIZOME**, horizontal, 15–30 Cm. (6–12') long, 5–7.5 Cm. (2–3') thick, covered with stipe

bases, "fingers"; these remain green several years, and often constitute the greater bulk of the official drug. When peeled—deprived of stipes, roots, etc., the rhizome itself is 7.5–15 Cm. (3–6') long, 12–25 Mm. ( $\frac{1}{2}$ –1') thick, cylindraceous, nearly straight, or curved, tapering towards one end, roughly scarred with remains of stipe-bases, or bearing longitudinal ridges and grooves, pale green when first peeled, becoming pale brown, fracture sharp, pale green, texture rather spongy, exhibiting 10 (*Filix-mas*) or 6 (*marginalis*) steles in a loose and interrupted circle; odor disagreeable; taste bitter-sweet, astringent, acrid, nauseous. **Solvents:** Alcohol; ether the best, as it extracts fixed oil, filicin, filicic acid, chlorophyll, volatile oil and resin, all being present in the official oleoresin. **Dose**, 3ss–2 (2–8 Gm.).

**ADULTERATIONS.**—Rhizomes of most indigenous ferns resembling the official, although such are thinner, free from chaff, and have stipes rarely closely imbricate, but when peeled and mixed identification becomes almost impossible; when unpeeled the composition and properties are less subject to change, and adulterations more easily detected; carelessness often renders the drug unreliable.

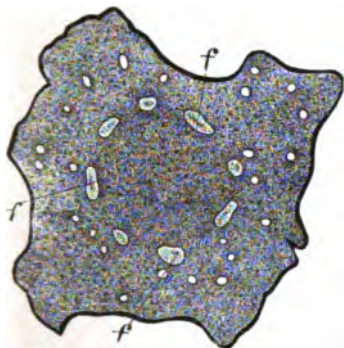
**Commercial.**—Rhizome should be collected when strongest—late summer; the chaff, dead portions of rhizome, and stipes should be

**POLYPODIACEÆ.**

discarded, using only such parts as have retained their internal green color, and these should quickly be dried and made into preparations, owing to rapid deterioration, as it usually becomes inert within 1–2 years. Soil and climate have greater influence upon amount of filicic acid than time of collection, the richest yield being from plants growing on soil of volcanic origin. The powder should be prepared freshly, have a bright green color, and always kept in well-stoppered bottles.

**CONSTITUENTS.**—Filicic acid 5–10 p. c., Filicin 19–31 p. c. (rohfilicin), fixed oil 6–7 p. c., filitannic acid 10 p. c., filix red, chlorophyll,

FIG. 10.



**Filix-mas:** transverse section magnified 3 diam.; f, fibro-vascular bundles.

FIG. 11.



**Filix-mas:** surface of peeled rhizome.

volatile oil, 2 resins. Böhm isolates aspidin (2–3 p. c.), albaspidin, aspidinin, aspidinol, and flavaspidic acid, and claims virtue to be chiefly in aspidin and filicic acid combined; Kraft and Jaquet believe the virtue to reside in filmaron. Dose, gr. 7–10 (.5–6 Gm.).

**Filicic (Filicinic) Acid,**  $C_{33}H_{42}O_{13}$ .—Most active constituent, white, amorphous or crystalline, tasteless, more soluble than its anhydride, poisonous. Dose, gr. 10–20 (.6–1.3 Gm.).

**Filicin (Filicic Anhydride),**  $C_{35}H_{40}O_{12}$ .—Yellowish-white, non-poisonous, inactive, crystalline, soluble in most solvents except aqueous; yields with fusing potassium hydroxide butyric acid and phloroglucin.

**PREPARATIONS.**—1. *Oleoresina Aspidii*. Oleoresin of Aspidium. (Syn., Oil of Fern; Br. Extractum Filicis Liquidum (Æthereum), Oleum Filicis Maris; Fr. Huile (Extrait étheré) de Fougère mâle; Ger. Extractum Filicis, Farnextrakt, Wurmextrakt, Wurmextrakt.)

**Manufacture:** Percolate 100 Gm. with acetone until exhausted, recover acetone by distillation on water-bath; yield 18 (ether 10–15) p. c. This contains filicic acid 5–10 p. c., some of which deposits in granular crystals upon standing, and must be mixed well with the liquid portion before dispensing. Should be kept in well-stoppered bottles. Dose, 3ss–1 (2–4 Cc.) every 3 hours; deaths have occurred from 3vj (24 Cc.).

**Unoff. Preps.:** *Extract*, dose, gr. 15–30 (1–2 Gm.). *Fluidextract*, dose, 3j–2 (4–8 Cc.).

PROPERTIES.—Tæniifuge, tonic, astringent.

USES.—This was known to the ancients as a vermifuge, being mentioned by Dioscorides, Galen, Pliny, Theophrastus, etc. In 1775 the King of France bought and made public this then secret tapeworm remedy from the Swiss surgeon Nouffer's widow.

When requiring this medicine the patient should fast the previous day, being nourished by only a little bread and milk; at night take ʒj (30 Cc.) of castor oil, to expel nidus, and on the following morning a full dose of oleoresin, still fasting; in 3 hours may repeat the dose. At noon may begin moderate eating, and at night should be given another cathartic—not castor oil, as it may aid absorption, but full dose of calomel, jalap, gamboge, Epsom salt or saline enemata, to clear away the dead worm.

*Allied Plants:*

1. *Dryopteris rigida* (*Aspidium rigidum*).—S. Europe, California. Rhizome longer, thinner, with 6 vascular bundles. *D. athaman'tica* (*A. athaman'ticum*). S. Africa. Rhizome thicker, firmer than official, inside brownish, with black resin dots, broader vascular bundles.

2. *Osmun'da rega'lis*, *Flowering Fern*, *Adian'tum peda'tum*, *Maiden-Hair* and *Polypo'dium vulga're*, *Common Polypody*.—All used for chronic catarrh, asthma, pectoral demulcent, tonic.

#### CLASS 4. LYCOPODINÆ.

##### 4. LYCOPODIACEÆ. Club-Moss Family.

Li-ko-po-di-a'se-e. L. *Lycopodi-um* + aceæ, fr. Gr. λύκος, a wolf, + ποῦς, ποδός, a foot—i. e., from appearance of the shoots to a wolf's foot. Herbs resembling mosses. Distinguished by creeping stems, corms; leaves small, sessile, 4–16 ranks; sporangia in axis of leaves or scales, 1–3-celled, often reniform, 2-valved, containing many yellow spores, of one kind only, marked at summit with 3 radiating lines; prothallia subterranean, with or without chlorophyll; monœcious; universal; emetic, purgative, aphrodisiac, acrid principle poisonous, some spores inflammable.

Genus: 1. *Lycopodium*.

#### LYCOPODIUM. LYCOPODIUM.

*Lycopodium*  
*clavatum*, Linné, } The spores.  
and other species.

*Habitat.* Europe, Asia, N. America, in dry woods.

*Syn.* Club Moss, Vegetable Sulphur, Brimstone or Powder, Wolf Claw, Fox Tail, Staghorn, Lycopodium Moss, Semen or Pulvis Lycopodii; Fr. Lycopode, Soufre végétal, Pied de Loup; Ger. Bärlappsaamen, Hexenmehl, Streupulver, Blitzpulver.

*Ly-co-po'di-um.* L. see etymology, above, of Lycopodiaceæ.

*Cla-va'tum.* L. *clavatus*, club like—i. e., alluding to club-like appearance of the fertile spikes.

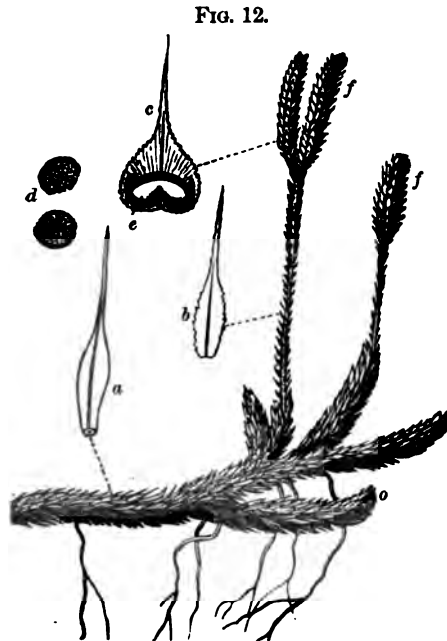
PLANT.—Low creeping perennial; stem .6–3 M. (2–10°) long, slender, tough, flexible, woody; branches ascending, leafy, the fertile terminated by a slender peduncle 10–15 Cm. (4–6') long, with 1–2

**LYCOPODIACEÆ.**

linear, cylindrical spikes—thecæ, cones, capsules, 2.5–5 Cm. (1–2') long; leaves linear, awl-shaped, 6 Mm. ( $\frac{1}{4}$ ') long, dense, light green, tipped, as are also the numerous bracts, on the flowering spikes with a fine bristle; in axils of bracts have the kidney-shaped sporangia containing the spores. SPORES, a pale yellowish fine powder, mobile, nearly inodorous and tasteless, floating upon water and not wetted by

it, but sinking on being boiled with it, burning with a quick flash and hissing when thrown into a flame, giving yellowish-white light; under microscope spores tetrahedral with one side convex, surface delicately reticulated, 0.025–0.040 Mm. ( $\frac{1}{800}$ – $\frac{1}{600}$ ') broad; edges beset with short projections; microscope should show no pollen, starch grains, or particles of sand. While *L. clavatum* furnishes most, yet considerable comes from *L. complanatum*, *L. annotinum*, and *L. inundatum*.

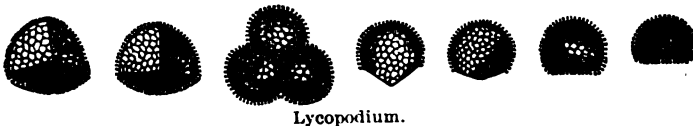
ADULTERATIONS.—1. Pollen of many Pinaceæ (*Pinus sylvestris*, *P. palustris*, etc.), always in 3's, consisting under the microscope of an elliptical cell with a globular cell at each end, is less fine and mobile, and mixes more easily with water than lycopodium.



*Lycopodium clavatum*: o, a fragment of stem with spore-bearing spikes, f, f'; a, leaf of stem; b, leaf of fertile branch; c, cone scale (bract) showing sporangium; d, spores.

gypsum (increase ash beyond 4–5 p. c., and quickly subside when shaken with carbon disulphide, chloroform, or water). 3. Starch, flour, sometimes 25 p. c. (blue with iodine and sink in carbon disulphide), dextrin (soluble in water, when concentrated precipitated by alcohol), sulphur (dissolves in carbon disulphide, remaining upon evaporation), rosin (treat with alcohol, evaporate the tincture), turmeric (reddish-brown with alkalis).

FIG. 13.



*Lycopodium*.

**Commercial.**—*Lycopodium* (club moss) is obtained by cutting off the tops when the fruit spikes (cones) are nearly ripe; afterward the



spores are shaken out of the sporangia, then sifted. Chiefly collected in Russia, Germany and Switzerland in July-Aug.

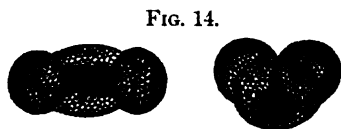


FIG. 14.

Pollen of pine.

CONSTITUENTS.—Fixed oil 47-49 p. c., cane-sugar 2 p. c., volatile base (methylamine), ash 4-5 p. c. (= sand + 1 p. c.  $P_2O_5$ ). The substance of the cell-wall is called pollenin; when treated with potassium hydroxide gives yellow color, becoming blue upon the

addition of sulphuric acid and iodine. The oil contains a peculiar oleic acid.

PROPERTIES.—Once considered diuretic, antispasmodic for rheumatism, epilepsy, pulmonary and renal disorders, dysentery.

USES.—Externally to protect tender and raw surfaces, erysipelas, eczema, herpes, ulcers, chafing in infants; in pharmacy as a basis for insufflations, also to prevent adhering of pills, suppositories, etc. Popular "homeopathic medicine" (1 to 100 milk-sugar triturated till oil liberated); internally gives excited circulation, urinary irritation, often cures dyspepsia, flatulence, constipation, aneurism, diphtheria, mucous membrane affections of lungs and bronchi.

### SUB-KINGDOM III. SPERMATOPHYT(ES)-A (PHANEROGAMIA).

Seed-producing plants, each containing a complete embryo, and includes the greatest number (120,000), as well as the highest forms of plants.

#### CLASS 5. GYMNOSPERMÆ (Seeds naked, not enclosed in an ovary).

##### 5. PINACEÆ (CONIFERÆ). Pine Family, Conifers.

Pi-na'se-e. L. *Pin-us* + aceæ, fr. Celtic *pin*, *pyn*, a mountain, rock—i. e., habitat of some species. Trees or evergreen shrubs. Distinguished by abounding in oleoresinous juice, leaves needle-shaped, entire, parallel-veined; flowers monœcious—staminate in catkins, without calyx or corolla—pistillate in cones; ovules naked, 2 or more on upper surface of each scape (carpel); fruit woody cone; seeds naked, cotyledons 2 or many, wood without ducts, with discoid markings; temperate climates; stimulant, diuretic, emmenagogue, anthelmintic, expectorant, timber.

Genera: 1. *Pinus*. 2. *Abies*. 3. *Juniperus*.

#### TEREBINTHINA. TURPENTINE.

*Pinus palustris*, Miller, } A concrete oleoresin.  
and other species.

*Habitat.* S. United States, Virginia to Texas, near the coast.

*Syn.* Long leaved-, Yellow Pitch-, Broom-, Pitch-, Swamp or Georgia Pine; Common Frankincense, Terebinthina Communis, Crude Turpentine; Br. *Thus Americana*, Frankincense; Fr. *Térébenthine commune*, T. de Bordeaux; Ger. (Gemeiner) Terpentin.

## PINACEÆ.

**PI'nus.** L. see etymology, page 68, of Pinaceæ.

**Pa-lus'tris.** L. *paluster*, swampy—i. e., it inhabits swamps or near marshy places.

**Ter-e-bin'thi-na.** L. *terebinthus*; Gr. *τερέβινθος*, of or from the *terebinth* = *turpentine tree*.

**Tur'pen-tine**, fr. *turbentine*, *terebinthine*, *terebinthina*.

**PLANT.**—*Pinus palustris* (*P. austri'lis*—i. e., southern); large tree, 18–30 M. (60–100°) high, .3–.6 M. (1–2°) thick, grows in dry sandy soil, from the sea to 100 miles (160 Km.) inland; bark thin, scaled, furrowed; wood hard, resinous; leaves many, crowded at end of branches, in 3's, .25–.4 M. (10–15') long, very narrow, sharp-pointed, triquetrous, in clusters surrounded by a sheath 25 Mm. (1') long; flowers sterile in violet aments, 5 Cm. (2') long; fruit cone, large, oblong, 15–25 Cm. (6–10') long, scales armed with short spine. Young trees resemble brooms; this furnishes nearly all the turpentine and rosin of commerce. **OLEORESIN** (turpentine), in yellowish, opaque masses, brittle in the cold, lighter internally, sticky, more or less glossy; terebinthinate odor and taste; alcoholic solution has acid reaction, rarely seen as yellow, opaque, viscid liquid. Dose, gr. 15–60 (1–4 Gm.).

**Commercial.**—Common white turpentine comes mostly from North Carolina, some from South Carolina and Georgia. It is secreted in the sapwood, exudes spontaneously somewhat, but to obtain it in large quantities the trees must be *boxed*, which consists in cutting, during winter, with a special axe, in the tree trunk 1–4 cavities, each holding 4–8 pints (2–4 L.); these are begun 20–30 Cm. (8–12') above ground, are triangular in shape, 30 Cm. (12') in width, 15 Cm. (6') in depth and height, being excavated downward. About 1 M. (3°) above each box the bark is removed and wood hacked in shape of letter L (*cornering*). The “crude” begins flowing the middle of March, but runs best July–Aug., slackening Sept.–Oct. Boxes are frequently emptied with “turpentine ladles or dippers” from which it is poured into barrels (250 pounds; 110 Kg.) to be used for distilling the oil. Every few weeks the trees are hacked a little higher, using ladders; the first year's flow, *virgin dip*, is best; yields 6½ gallons (24 L.) of oil per barrel and window glass rosin. Succeeding years yield *yellow dip*, giving 4 gallons (15 L.) of oil per barrel and ordinary grades of rosin. Some hardens on trees, *scrapings*, *scrape*, which gives 2 gallons (7.5 L.) of oil per barrel, and brownish-black rosin.

**CONSTITUENTS.**—Volatile oil 20–30 p. c., Rosin (resina, resin) 50–60 p. c., bitter principle, formic, succinic, and possibly other resin acids—pinic and sylvic acids.

**Oleum Terebinthinæ.** Oil of Turpentine,  $C_{10}H_{16}$ , *official*.—(Syn.,

FIG. 15.

*Pinus palustris.*

Fr. Essence de Térébenthine (Huile volatile de T.) ; Ger. Terpentinöl). This volatile oil is obtained by distilling the oleoresin (turpentine) with water or steam ; when oil ceases to come over, the resin (rosin) is run off from bottom of still and strained into barrels ; on condensing dis-

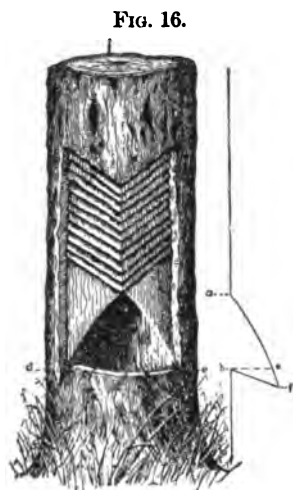


FIG. 16.  
A boxed, cornered, and chipped pine tree.

tillate the oil floats on top of the water, when it is dipped out and barrelled for market. It is a thin, colorless liquid, characteristic odor and taste, both becoming stronger and less pleasant by age, owing to formation of ozone, resin, formic and acetic acids, sp. gr. 0.870, boils at  $155^{\circ}$ – $162^{\circ}$  C. ( $311^{\circ}$ – $324^{\circ}$  F.), soluble in 3 volumes alcohol ; with hydrochloric acid forms artificial crystalline camphor,  $C_{10}H_{16}HCl$  ; consists chiefly of dextrogyrate pinene (French oil levogyrate), often pinene derivatives, camphene, fenchene. *Tests* : 1. Oil 5 Cc. shaken with 5 Cc. potassium hydroxide T. S. should become only a light straw-yellow upon standing 24 hours. 2. 1 Cc. evaporated should leave only slight residue (abs. of petroleum, paraffin oils, rosin). 3. 3 drops evaporated on white filter paper should leave no permanent stain (abs. of kerosene, rosin oil). Should be kept in well-stoppered bottles.

**ADULTERATIONS.**—Tar oils, kerosene, petroleum benzin, paraffin oils, rosin oil, etc.

**Resina, Rosin, official.**—(Syn., Resin, Colophony ; Fr. Résine blanche (jaune) ; Ger. Colophonium, Kolophonium, Geigenharz.) The residue left after distilling off the volatile oil from turpentine. It is usually in sharp, angular fragments, translucent, amber-colored, often covered with a yellowish dust, at ordinary temperature brittle, pulverizable, fracture shiny, shallow-conchoidal, odor and taste faintly terebinthinate, sp. gr. 1.075, easily fusible, burning with dense yellowish smoke, no ash, soluble in alcohol, ether, benzene, carbon disulphide, acetic acid, fixed and volatile oils, solutions of sodium or potassium hydroxide ; its varieties depend upon color, and that upon degree of heat used in distillation—the older the trees the greater the yield of rosin, the less that of oil ; contains anhydride of abietic acid,  $C_{14}H_{22}O$ , 80–90 p. c., pinic and sylvic acids. By shaking rosin with warm diluted alcohol, abietic anhydride is converted into abietic acid,  $C_{14}H_{24}O_2$ , which is crystalline, soluble in carbon disulphide, benzene, alcohol, ether, chloroform, alkalies, glacial acetic acid. When boiled with alkaline solutions get greasy salts of abietic acid = rosin soap ; if distilled with superheated steam, get benzene and toluene.

**PREPARATIONS.**—I. **OLEORESIN** : 1. *Ceratum Resinae Compositum*, 11.5 p. c.

## PINACEÆ.

II. OIL: 1. *Oleum Terebinthinæ Rectificatum*. Rectified Oil of Turpentine. (Syn., Fr. Essence de Térébenthine rectifiée; Ger. Gereinigtes Terpentinsöl.)

*Manufacture*: Shake oil of turpentine thoroughly with equal quantity solution sodium hydroxide, recover by copper still three-fourths of oil, separate clear oil from water, filter. It is a thin, colorless, liquid, sp. gr. 0.865, no residue. Should be kept cool, in well-stoppered, amber-colored bottles. Dose, stimulant, diuretic, Mv-30 (.3-2 Cc.), anthelmintic, zss-4 (2-15 Cc.).

Preps.: 1. *Emulsum Olei Terebinthinæ*. Emulsion of Oil of Turpentine. (Syn., Turpentine Emulsion; Fr. Emulsion d'essence de Térébenthine; Ger. Terpentinsölemulsion.)

*Manufacture*: Add acacia 15 Gm. to dry bottle, then rectified oil of turpentine 15 Cc. + expressed oil of almond 5, shake thoroughly, add water 30, shake vigorously; when emulsified add syrup 25, in several portions, shaking after each, finally add water in divided portions with shaking q. s. 100 Cc. Dose, 3j-8 (4-30 Cc.).

2. *Terpini Hydras*. Terpin Hydrate,  $C_{10}H_{18}(OH)_2 + H_2O$ . (Syn., Ger. Terpinum hydratum, Terpinhydrat.)

*Manufacture*: This hydrate of the diatomic alcohol terpin is obtained by mixing in a shallow porcelain dish rectified oil of turpentine 4 parts, alcohol 3, nitric acid 1, letting stand 3-4 days; crystals form which are collected, drained, dried on paper, and recrystallized from cold alcohol. It is in colorless, lustrous, rhombic prisms, nearly odorless, slightly aromatic, somewhat bitter taste, permanent, soluble in 200 parts water, 10 alcohol, 100 ether, 200 chloroform, melts at  $117^{\circ} C.$  ( $243^{\circ} F.$ ), with loss of water, sublimes, no residue; yield 12 p. c. (as to oil taken). Should be kept in well-stoppered bottles. Dose, gr. 2-15 (.13-1 Gm.).

2. *Linimentum Terebinthinæ*. Turpentine Liniment. (Syn., Fr. Liniment Térébenthiné; Ger. Terpentinliniment.)

*Manufacture*: 35 p. c. Dissolve resin cerate 65 Gm., previously melted on water-bath, in oil of turpentine q. s. 100 Gm.; mix thoroughly.

3. *Terebenum*. *Terebene*,  $C_{10}H_{16}$ . (Syn., Fr. Térébène; Ger. Tereben.) A liquid consisting of dipentene (chiefly) and other hydrocarbons (terpinene, cymol, camphene, etc.)

*Manufacture*: Add sulphuric acid 1 part gradually to oil of turpentine 20, neutralize with chalk, distil; may further rectify with steam. It is a colorless, thin liquid, agreeable thyme-like odor, aromatic, somewhat terebinthinate taste, sp. gr. 0.850, soluble in 3 volumes alcohol, slightly in water, on exposure becomes resinified, with acid reaction. *Impurities*: Acids, unaltered oil of turpentine, resinous substances. Should be kept cool, dark, in well-stoppered bottles. Dose, Mv-15 (.3-1 Cc.).

*Unoff. Prep.*: *Linimentum Terebinthinæ Aceticum* (Br.), 50 p. c. + glacial acetic acid 12.5, camphor liniment 50.

III. ROSIN: 1. *Ceratum Resinæ*. Rosin Cerate. (Syn., Basilicon

Ointment, Br. Unguentum Resinæ, (—Tetrapharmacum,—basilicum); Fr. Cérat (Onguent) de Résine anglais; Ger. Königssalbe, Harzsalbe, Zugsalbe.)

*Manufacture*: Heat until liquefied rosin 35 Gm., add yellow wax 15, lard 50, strain, allow to congeal with occasional stirring; in cold weather may use yellow wax 12, lard 53.

Prep.: 1. *Linimentum Terebinthinæ*, see page 71.

2. *Ceratum Resinæ Compositum*. Compound Rosin Cerate. (Syn., Deshler's Salve; Fr. Cérat de Résine composé; Ger. Zusammengesetzte Harzalbe.)

*Manufacture*: Heat until liquefied rosin 22.5 Gm., yellow wax 22.5, turpentine 11.5, prepared suet 30, then add linseed oil 13.5, strain, stir until it begins to congeal.

3. *Ceratum Cantharidis*, 18 p. c.

**PROPERTIES.** I. **TURPENTINE AND OIL.**—Internally—stimulant, carminative, cathartic, anthelmintic, hæmostatic, expectorant, diuretic, diaphoretic, antipyretic. Externally—rubefacient, irritant, counter-irritant, antiseptic, disinfectant. Mostly all due to volatile oil. It contracts vessels, increases peristalsis, gastric secretion, stimulates heart, depresses nervous system. Large doses produce gastro-enteritis, vomiting, diarrhoea, suppresses urine, gives lumbar pains, urethral burning, hæmaturia, strangury, insensibility, death by paralyzed respiration. It is excreted by the skin, bronchi, and kidneys; inhaling vapors give nasal, ocular, and renal irritation.

II. **TERPIN HYDRATE.**—Antiseptic (arresting the development of tubercle bacilli), expectorant, diuretic, diaphoretic.

III. **TEREBENE.**—Stimulant, disinfectant, expectorant, astringent.

IV. **RESIN.**—Antiseptic, slight stimulant.

**USES.**—I. **TURPENTINE AND OIL**: Internally—chronic bronchial catarrh, cystitis, gonorrhoea, leucorrhoea, gleet, chronic urinary troubles, piles, hemorrhages, puerperal fever, inflammation of bowels, traumatic erysipelas, intestinal worms, pneumonia, phosphorus-poisoning (old oil). Externally—rheumatism, sciatica, lumbago, neuralgia, bronchitis, pleurisy, peritonitis, tympanites, renal colic, gangrene, sprains, wounds, scabies, ringworms, enlarged glands, burns, frostbites, colic; vapors of oil in whooping-cough, diphtheria, laryngitis. Often associated with various liniments, chloroform, camphor, olive oil, narcotic extracts, etc. Administer the oleoresin in pill form, hardened with magnesium oxide, or the oil dropped on sugar or emulsified.

II. **TERPIN HYDRATE.**—Acute and chronic bronchitis, whooping-cough, chronic nephritis, chronic cystitis, gonorrhoea.

III. **TEREBENE.**—Chronic bronchitis by inhalation and on sugar.

IV. **RESIN.**—Indolent ulcers, sores, wounds, in plasters, ointments, as emulsifying agent, chronic enteritis.

*Poisoning*: Have giddiness, gastro-enteritis, strangury, bloody scanty urine, with violet odor; may have purging, cyanosis, dilated pupils, stertorous breathing, feeble, rapid pulse, coma, collapse. Give emetics, if no purging use enema, then plenty of water and demulcent drinks, hot fomentations to loins, opium to allay pain.

## PINACEÆ.

*Allied Products:*

1. **Pix Liquida. Tar, official.**—(Syn., *Resina Empyreumatica Liquida*; Fr. *Goudron végétal*; Ger. *Holztheer, Theer*.) A product obtained by the destructive distillation of the wood of *Pinus palustris* and other species of *Pinus* (*P. Tæ'da*, *P. rig'ida*, *P. sylves'tris*, and *Larix sibir'ica*.)

**Manufacture:** Refuse pine wood is cut into billets, which are then stacked closely upon one another and covered with earth; the wood is set on fire from an aperture left at the apex, and slow combustion without flame allowed to proceed. At the bottom a ditch serves to run off the tarry liquid, whence it is ladled into barrels; the wood is converted into charcoal. In Europe permanent clay furnaces are used over and over. Tar is a true, impure turpentine, semi-liquid, viscid, blackish-brown, non-crystalline, translucent in thin layers, granular, and opaque with age; odor empyreumatic, terebinthinate; taste sharp, empyreumatic, soluble in alcohol, fixed or volatile oils, solutions sodium or potassium hydroxide, heavier than water, slightly soluble in it—solution pale yellowish-brown, acid reaction. Dose, gr. 5–30 (.3–2 Gm.), in pill.

**CONSTITUENTS.**—Acetic acid, small quantities of formic, propionic, capronic acids, acetone, methyl alcohol, mesit, toluol, xylol, cumol, methol (all passing over with the light oil of tar), naphthalene, pyrene, chrysene, paraffin, phenols, creosote (25 p. c.), pyrocatechin, empyreumatic resin.

**PREPARATIONS.**—1. *Syrupus Picis Liquidæ.* Syrup of Tar. (Syn., *Syrupus Piceus*; Fr. *Sirop de Goudron*; Ger. *Theersirup*.)

**Manufacture:** Triturate tar 5 Gm. with clean white sand 10, add water 10 Cc., reject liquid, treat residue with alcohol 5, when tar dissolved add magnesium carbonate 1 Gm., sugar 50, after trituration add water 40 Cc., after 2 hours filter, add sugar 35 Gm., heat until dissolved, strain, add water q. s. 100 Cc. Dose, ʒj–4 (4–15 Cc.).

2. *Unguentum Picis Liquidæ.* Tar Ointment. (Syn., Fr. *Pomatum cum Pice*, *Pommade de Goudron*; Ger. *Theersalbe*.)

**Manufacture:** 50 p. c. Melt yellow wax 15 Gm., add lard 35, to melted mixture add tar 50, previously warmed, incorporate thoroughly, strain, stir until it congeals.

3. *Oleum Picis Liquidæ.* Oil of Tar. (Syn., Fr. *Huile volatile de Goudron*; Ger. *Theeröl*.) This volatile oil distilled from tar is an almost colorless liquid when fresh, but soon acquires a dark reddish-brown color, strong, tarry odor and taste, sp. gr. 0.965, soluble in alcohol, acid reaction; contains hydrocarbons, phenols of acetic and other acids, undetermined empyreumatic products present in tar—it is largely oil of turpentine; it may be made into a water and pills. Dose, Mij–5 (.13–.3 Cc.).

**PROPERTIES.**—Tar similar to oil of turpentine, but milder, scarcely ever vesicates, stimulant, expectorant, counter-irritant, insecticide. Internally—disturbs digestion, large doses may cause vomiting, colic, pain, headache, dark urine similar to phenol (carbolic acid).

**USES.**—Internally—bronchitis, phthisis, vesical catarrh, constipation.

Externally—scabies, scaly eruptions, eczema, burns, boils, sores, ulcers, gangrene, fissured nipples, hemorrhoids; fumes destroy foul odors.

2. *European Turpentine* from *P. Pinaster*, *P. Laricio*, *P. sylvestris*, *P. rotundata* and other allied species; similar to our official.

3. *Chian Turpentine*, *Terebinthina Chia* (*Pistacia Terebinthus*), from Island of Chio or Scio. It is a greenish-yellow liquid, hardens to transparent mass, odor fennel-like, terebinthinate, taste mildly bitter. Once used for uterine cancer, but now in disfavor. Dose, gr. 20 (1.3 Gm.).

4. *Pix Carbonis Præparata* (Br.).—Heat coal-tar at 48.9° C. (120° F.) for 1 hour (stirring).

*Allied Plants:*

1. *Pinus Taeda*, *Loblolly*, *Old Field* or *Frankincense Pine*.—Delaware, Florida, thence Texas, Arkansas. Grows along with *P. palustris*, and like it is a large tree, 18–30 M. (60–100°) high, but leaves (15–25 Cm.; 6–10' long) and cones (7.5–12.5 Cm.; 3–5' long) are smaller. This yields not near so great a per cent. of oleoresin as official plant, but one quite as good, consequently it is utilized for this and other purposes.

2. *P. sylvestris*, *Wild Pine*, *Scotch Fir*.—Europe. Tree 21–24 M. (70–80°) high, leaves and cones only 5–7.5 Cm. (2–3') long; this yields much of the common European turpentine. *P. Pinaster* (*P. maritima*). S. Europe. Much used for obtaining turpentine, pitch, and tar.

3. *Larix Larix* (*L. europæa*, *Pinus Larix*), *Venice Turpentine* (*Terebinthina Veneta*).—Obtained from heartwood by bore holes; yellowish-green, transparent, fluorescent, odor terebinthinate, balsamic, soluble in alcohol.

4. *Pini'tes succinifer* (*Picea succinifera*), *Succinum* (*Amber*).—A fossil resin, official 1820–1860. Baltic Sea, Prussia, coal mines. There are 50 Pinaceæ species that yield this resin. Such trees have been submerged under seawater, and from time to time yield by natural exudation this oleoresin, which is found along shores under and above water in irregular sized pieces, that of 13 pounds (6 Kg.) being, so far, the largest; it is rough, dull, hard, brittle, fracture conchoidal, glossy, transparent, yellowish-red, sp. gr. 1.09, aromatic when heated, tasteless, melts at 288° C. (550° F.), yielding succinic acid, if heated higher get water, volatile acids, empyreumatic oil; contains succinic acid,  $C_4H_6O_4$ , several resins. Used for preparing succinic acid and (empyreumatic) oil of amber, for fumigation, in the arts.

*Oleum Succini*, official 1820–1860.

*Oleum Succini Rectificatum*, official 1820–1890. Used as stimulant, antispasmodic, diuretic for hysteria, whooping-cough, infantile convulsions, intestinal irritation, amenorrhœa. Externally—rheumatism, rubefacient liniments. Dose, Mv–15 (.3–1 Cc.).

5. *Tsu'ga* (*Abies*) *canaden'sis*, *Pix Canadensis*, (*Canada Pitch*, *Hemlock Pitch*).—Prepared resinous exudation, official 1840–1890. N. America. Hemlock spruce is an evergreen tree 18–24 M. (60–80°)

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high, .6–1 M. ( $2-3^{\circ}$ ) thick, trunk straight, uniform size for 12–15 M. ( $40-50^{\circ}$ ), bark rough; leaves 18 Mm. ( $\frac{1}{4}'$ ) long, 2 Mm. ( $\frac{1}{12}'$ ) wide, in 2 rows, numerous, glaucous, silvery beneath, cones ovate, 2.5 Cm. ( $1'$ ) long, resin (oleoresin) reddish-brown, translucent, or opaque, nearly hard, brittle, fracture shining, conchoidal; odor mild, balsamic, terebinthinate. Oleoresin is obtained by exudation, incision, or boxing; yield small. Used as stimulant, irritant, in plasters.

*Emplastrum Picis Canadensis*, official 1860–1890.

## TEREBINTHINA CANADENSIS. CANADA TURPENTINE.

**Abies**  
**balsamea**, (Linné) Miller. } A liquid oleoresin.

*Habitat.* Canada, N. United States to Virginia, west to Minnesota.

*Syn.* Fir Balsam Tree, Balm of Gilead Fir, Balsam Spruce, Hemlock Fir, Balsam Poplar, American Silver Fir, Canada Balsam, Balsam of Fir, Balsamum Canadense; Fr. Térébenthine du (Baume de) Canada, Térébenthine; Ger. Canadischer Terpentin.

**Ab'1-es.** L. fir tree—i. e., classic name, Gr. *ἐλάτη*.

**Bal-sa-me-a.** L. of balsam, balsamic—i. e., has the nature of balsam.

**PLANT.**—Beautiful and ornamental tree of damp woods, mountain swamps, 9–15-M. ( $30-50^{\circ}$ ) high; at high elevations a low shrub, branches numerous, giving tree a pyramidal shape; bark smooth, reddish-gray when young, filled with blisters (reservoirs) containing the balsam; leaves 2 Cm. ( $\frac{1}{2}'$ ) long, linear, silvery beneath; flowers—staminate in catkins, pollen bright yellow—pistillate in cones, bluish solitary, 5–10 Cm. ( $2-4'$ ) long, 2.5 Cm. ( $1'$ ) thick; seeds with a large wing. **OLEORESIN** (Canada turpentine), viscid, pale yellowish or greenish-yellow, transparent; odor agreeable; taste terebinthinate, bitter, slightly acid; on exposure gradually dries to a transparent varnish; solidifies when mixed with 20 p. c., by weight, of magnesium oxide previously moistened with water, soluble in ether, chloroform, benzene. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATION.**—Rosin dissolved in oil of turpentine and flavored with oil of wormwood (Factitious Oregon Balsam of Fir).

**Commercial.**—Canada turpentine is mostly from Canada; it is obtained by balsam gatherers, who, with families, encamp yearly in woods for two months. This turpentine secretes in vesicles of the bark, which, when pierced by the sharp-pointed nozzle of the “balsam-collector’s can,” readily empty their contents into the cans. Each tree yields about 8 ounces (.24 Kg.), and a family can collect a gallon (4 L.) daily. Retapping occurs every 2 or 3 years, each time yielding less; the largest crop in Laurentine Mountains, Quebec, in a single year was 5,000 gallons (19,000 L.).

**CONSTITUENTS.**—Volatile oil,  $C_{10}H_{16}$ , 24 p. c., acid resin 63 p. c., indifferent resin 12 p. c., the acid portion contains 4 acids—canadinic, canadolic, *a*- and *b*-canadinolic; four-fifths of the resin (acid) is soluble in boiling alcohol, sodium hydroxide solution, one-fifth in ether only.

FIG. 17.



Can for collecting balsam of fir.



PREPARATION.—1. *Collodium Flexile*, 5 p. c.

PROPERTIES AND USES.—Like oil of turpentine, except this dries into an adhesive varnish, thus acting as a protective.

*Allied Plants:*

1. *Abies Abies* (*excel'sa*), *Pix Burgundica*, *Burgundy Pitch*.—The prepared resinous exudation, official 1820–1900. S. Europe (Burgundy province, France). Lofty tree, 24–45 M. (80–150°) high; leaves short, 4-cornered, green; flowers, staminate and pistillate; fruit purple, cylindrical; scales oval. The oleoresin (Jura turpentine) is obtained from incisions made through the bark, after which it is melted in water and strained, thus yielding the once official product. It is yellowish-brown, hard, yet gradually conforming to the container, shining, conchoidal fracture, opaque or translucent, brittle, softened by heat,

FIG. 18.



*Abies Abies* (*excelsa*).

aromatic, terebinthinate, sweetish, not bitter; contains volatile oil 5 p. c., water 5–10 p. c. (absorbed during treatment), remainder is resin (chiefly abietic acid). Stimulant, counter-irritant, in plasters as a base and for support; rheumatism, joint affections, chest troubles, pleurisy, bronchitis, catarrh, asthma, hepatitis, phthisis, pneumonia.

2. *A. Fra'seri*.—Resembles official, but cones only 5 Cm. (2') long, sharp-pointed scales projecting and recurved. New England, North Carolina, in mountains; used for collecting balsam of fir.

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3. *A. Pi'cea* (*pectina'ta*), *Strassburg Turpentine* (*Terebinthina Argentoratensis*).—Vosges. Obtained like Canada balsam, chiefly differing in odor (lemon); taste bitter, not acrid; completely soluble in absolute alcohol.

4. *A. Menzie'sii*, *Oregon Balsam of Fir*.—This resembles Canada balsam when fresh, but becomes gradually granular and opaque.

5. *Thu'ja occidenta'lis*, *Arbor Vita* (*White Cedar*).—The fresh tops, official 1880–1890. Canada, United States. Tree resembles closely (*hamæcyp'aris sphaeroi'dea* (*Cupres'sus thyo'i'des*), 6–15 M. (20–50°) high, trunk crooked, bark pale, shreddy, wood light, soft, durable; leaves 4 rows, rhomboid-ovate, pointed, roundish gland on the back, balsamic, terebinthinate odor; pungent, camphoraceous, bitter taste; twigs flattish; contains volatile oil 1 p. c., resin, tannin, pinipicrin, thujin, thujigenin. Used as stimulant, diuretic, irritant for intermittents, coughs, fevers, scurvy, rheumatism, amenorrhœa, dropsy, worms, pulmonary catarrh, ulcers, warts; in infusion, decoction, fluidextract. Dose, gr. 15–60 (1–4 Gm.).

6. *Ag'athis loranthifo'lia* (*Dam'mara*), *Dammar*.—E. India. A spontaneous resinous exudation, in transparent, straw-colored rounded masses, almost odorless and tasteless, fracture conchoidal; contains resin of which 40 p. c. is insoluble in alcohol and 60 p. c. soluble; by distillation get terpene,  $C_{10}H_{16}$ . Used mostly in varnishes, rarely in plasters. That from New Zealand—*Kauri Resin*—is found also fossil and often sold as copal.

7. *Cal'litris quadri'val'ris*, *Sandaraca* (*Sandarac*).—N. W. Africa. It is a resin which exudes spontaneously or from incisions made through the bark: occurs in elongated pale yellow tears 5–15 Mm. ( $\frac{1}{8}$ – $\frac{3}{8}$ ') long, covered with whitish dust, of a glass-like lustre, transparent, hard, brittle; odor and taste terebinthinate, balsamic, bitter, soluble in hot alcohol, ether; it resembles peas in size, often mixed with mastic, owing to its cheapness, but distinguished by being pulverulent when chewed (and not adhesive as with mastic); contains 3 resins, differing in solubility, also bitter principle; according to Tschirch—sanduracolic acid 85 p. c., callitric acid 10 p. c., volatile oil depending upon freshness; mild stimulant. Mainly used in varnishes.

## JUNIPERUS. JUNIPER.

*Oleum Juniperi*. Oil of Juniper, *official*.

*Juniperus communis*, Linné. } A volatile oil distilled from the fruit.

*Habitat*. N. America, Canada, N. United States, Asia, Europe, N. Africa; dry woods, hills.

*Syn*. Juniper Bush or Berries, *Fructus* (*Baccæ*) *Juniperi*; Fr. *Genièvre*, *Baies de Genièvre*; Ger. (Gemeiner) *Wachholderbeeren*. Oil of Juniper Berries, *Oleum Fructus* (*Baccæ*) *Juniperi*; Fr. *Essence de Genièvre*; Ger. *Wachholder(beer)öl*.

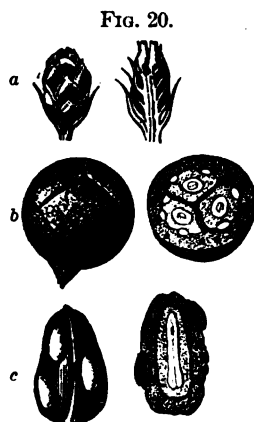
*Ju-ni-pe-rus*. L. fr. *Celtic juniperus*, rough—i. e., its foliage; or fr. *L. juvenis*, young, + *parere*, to produce—i. e., young fruit, leaves, etc., are continually replacing the old.

*Com-mu'nis*. L. common, general—i. e., the usual or ordinary kind.

**PLANT.**—Evergreen shrub 2–5 M. ( $6\text{--}15^{\circ}$ ) high, with many close branches, some often prostrate; leaves narrow, longer than fruit, 12 Mm.



*Juniperus communis.*



*Juniperus*: a, fertile catkin and longitudinal section; b, galbulus and transverse section; c, seed and longitudinal section magnified.

( $\frac{1}{2}$ ') long, in whorls of 3's, sharp-pointed, channelled, deep green; flowers dioecious—staminate catkins, pistillate cones; fruit (galbulus) roundish berry, 8 Mm. ( $\frac{1}{3}$ ') broad, dark purplish with bluish-gray bloom, 3-rayed, pulpy, 3-seeded, oil-glands on surface, ripens second year; odor and taste terebinthinate.

**CONSTITUENTS.**—Volatile oil 0.5–2.5 p. c., sugar 15–30 p. c., resin 10 p. c., juniperin, proteids 4 p. c., fat, wax, malates, formic and acetic acids.

**Oleum Juniperi.** Oil of Juniper.—Obtained from the fruit by distillation with salt and water, or steam; it is a greenish-yellow liquid, darker, thicker by age, characteristic odor of juniper, warm, aromatic, somewhat terebinthinate, bitter taste, sp. gr. 0.875, soluble in 10 volumes 90 p. c. alcohol, fulminates with iodine; contains chiefly pinene,  $C_{10}H_{16}$ , with some cadinene,  $C_{15}H_{24}$ , juniper camphor, and an ester to which odor and taste are due. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{M}\nu$ –15 (.3–1 Cc.).

**PREPARATIONS.**—1. *Spiritus Juniperi.* Spirit of Juniper. (Syn., Fr. Alcoolat (Esprit) de Genièvre; Ger. Wachholderspiritus.)

*Manufacture*: 5 p. c. Oil 5 Cc. dissolved in alcohol 95 Cc. Dose,  $\mathfrak{zj}$ –4 (4–15 Cc.).

2. *Spiritus Juniperi Compositus.* Compound Spirit of Juniper. (Syn., Fr. Alcoolat de Genièvre composé; Ger. Zusammengesetzter Wachholderspiritus.)

*Manufacture*:  $\frac{2}{3}$  p. c. Oil .4 Cc., oil of caraway .05, oil of fennel .05, alcohol 70, water q. s. 100 Cc. Dose,  $\mathfrak{zj}$ –4 (4–15 Cc.).

*Unoff. Preps.* Fruit: *Fluidextract*, dose,  $\mathfrak{zj}$ –2 (4–8 Cc.). *Extract*, dose, gr. 10–30 (.6–2 Gm.). *Infusion*, 5 p. c., dose,  $\mathfrak{zss}$ –2 (15–60 Cc.). *Succus Juniperi inspissatus* (Ger.), 20 p. c.

**PROPERTIES.**—Similar to turpentine; stimulant, diuretic, anodyne, emmenagogue, carminative, stomachic, antiseptic.

**USES.**—Renal dropsy, vesical catarrh, rheumatic pains, swellings.

## PINACEÆ.

## JUNIPERUS OXYCEDRUS. PRICKLY CEDAR.

**Oleum Cadinum.** Oil of Cade, *official*.

**Juniperus**  
**Oxycedrus, Linné.** } An oily product of dry distillation of the wood.

*Habitat.* S. Europe, Spain.

*Syn.* Prickly-, Spanish-, or Berry-bearing Cedar, Large Brown-fruited Juniper; *Oleum Juniperi*, *Empyreumaticum*, *Empyreumatic Oil of Juniper*, *Juniper Tar Oil*; Fr. *Huile de Cade*; Ger. *Kadeöl*, *Radiöl*.

**Ox-y-ce'drus.** L. fr. Gr. *ὄξις*, sharp, pointed, + *κέδρος*, cedar—*i. e.*, cedar with pointed leaves.

**PLANT.**—Shrub 2.4–3.7 M. (8–12°) high, resembling *J. communis*, branches spreading, drooping; leaves medium size, awl-shaped, pointed, 2 furrows on upper edge; fruit 12 Mm. ( $\frac{1}{2}$ ') thick, reddish, shining, 2 white lines on apex.

**Oleum Cadinum.** Oil of Cade.—Should be dry distilled from heartwood; it is a dark brown, clear, thick liquid, tarry odor, burning, empyreumatic, bitter taste, sp. gr. 0.990; contains phenols and sesquiterpene—cadinene,  $C_{15}H_{24}$ ; partly soluble in alcohol, completely in ether, chloroform, carbon disulphide, nearly insoluble in water, but imparts to it acid reaction. The oil from *J. communis* wood often substituted. Dose, Mij–5 (.2–.3 Cc.).

**PROPERTIES.**—Anthelmintic, externally parasiticide.

**USES.**—Psoriasis, pityriasis rubra, chronic eczema, prurigo, psora, favus. This oil can be substituted for official *Oleum Picis Liquidæ*, both having about the same effect.

## SABINA. SAVIN.

**Juniperus**  
**Sabina, Linné.** } The tops.

*Habitat.* Siberia, Europe, Canada, N. United States (Me. to Wis.); rocky banks.

*Syn.* Savine, Saving Tree, Shrubby Red Cedar, *Sabinæ Cacumina*, Savine Tops; Fr. *Sabine*; Ger. *Summitates* (*Herba*) *Sabinæ*, *Sevenbaum*, *Sadebaumspitzen*, *Sevenkraut*.

**Sa-bi'na.** L. *sabinus*, of the Sabines, town and people of ancient Italy, next the Latins, who used this juniper as incense.

**PLANT.**—Evergreen procumbent or erect shrub, 1–4.5 M. (3–15°) high, compact, spreading by many divided branches; bark pale reddish-brown, scaling off, that of young branches light green, adhering; leaves many, small, erect, pointed, glandular in middle, imbricated in 4 rows; flowers May–June, dioecious, staminate in catkins, pistillate small cones; fruit (galbulus, coalesced scales) berry-like, size of a pea, bluish-purple, whitish bloom, soft, enclosing 1–3 seeds. **TOPS**, short, thin, yellowish-green, subquadrangular branchlets; leaves in 4 rows, opposite, dark green, scale-like, ovate-lanceolate, acute, appressed, imbricated, on the back a shallow groove, containing oblong or roundish gland; odor peculiar, terebinthinate; taste disagreeable, resinous, bitter. **Solvents**: boiling water; alcohol. Dose, gr. 5–15 (.3–1 Gm.); in syrup or honey.

**Commercial.**—Savin grows in Switzerland, Germany, France, Aus-

tria, Spain, Italy at 1,500 M. (5,000°) or greater elevations, especially hugging the Alps. In Asia it follows the Caucasus 3,600 M. (12,000°) elevation. It was grown in English gardens as early as 1550; not much cultivated now. Tops are collected in spring, and the young, green shoots separated from the woody branches. By microscope can

FIG. 21.

*Juniperus Sabina.*

detect, in coarse powder even, the bordered pits so characteristic of gymnospermous wood-cells, hence this is of importance in poison cases.

CONSTITUENTS.—Volatile oil 2–5–10 p. c., resin, tannin, salts of potassium, calcium.

*Oleum Sabinæ.* Oil of *Savin*, *official*.—(Syn., Fr. Essence de Sabine; Ger. Sadebaumöl.) This volatile oil is obtained by distilling the fresh tops of savin with water or steam; yield 1.5–2.5 p. c.; if fresh berries used, get 8–10 p. c. of inferior oil. It is a colorless or yellowish liquid, peculiar terebinthinate odor, pungent, bitter, camphoraceous taste, sp. gr. 0.920, soluble in  $\frac{1}{2}$  volume or more 90 p. c. alcohol; contains as chief constituent an alcohol—sabinol,  $C_{10}H_{15}OH$ , 10 p. c. in free state, 40–44 p. c.

as ester (sabinol acetate,  $C_{10}H_{15}C_2H_3O_2$ ), also cadinene,  $C_{15}H_{24}$ , and pinene,  $C_{10}H_{16}$ . Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{m}\jmath$ –5 (.06–.3 Cc.).

ADULTERATIONS.—OIL: Oil of turpentine, oil of juniper, the former more frequently—not more than 25 p. c. should distil over below 200° C. (392° F.); different solubility in alcohol.

PREPARATIONS. — 1. *Fluidextractum Sabinæ*. Fluidextract of Savin. (Syn., Extractum Sabinæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Sabine; Ger. Flüssiges Sadebaumextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{m}\nu$ –15 (.3–1 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 1–4 (.06–.26 Gm.). *Tincture*, dose,  $\mathfrak{z}\jmath$ –2 (4–8 Cc.). *Infusion*, dose,  $\mathfrak{z}\jmath$ –2 (30–60 Cc.). *Cerate* (fluid-extract 25 + rosin cerate 90; to latter melted add former, evaporate off alcohol). *Ointment*.

PROPERTIES.—Diuretic, emmenagogue, ecboic, irritant, hæmagogue, vermifuge. Oil is similar to but more powerful than oil of turpentine, irritating ovaries (accelerating menstruation) and uterus (inducing contractions). Large doses produce vomiting, purging, abortion, severe pain, rupture of gall-bladder, death.

USES.—Amenorrhœa, dysmenorrhœa, menorrhagia, sterility, chlorosis, chronic rheumatism, gout; externally—powder or infusion applied to warts, indolent ulcers, dental caries, tinea capitis, polypi, venereal condylomata. Cerate prolongs secretion from blisters, stimulates healing of gangrenous ulcers, often combined with burnt alum, cupric subacetate. Oil is the best internal form, which should be given in emulsion, pill, or alcoholic solution.

## GRAMINACEÆ.

**Poisoning:** Have abdominal pain, vomiting, straining, difficult respiration, strangury, bloody urine and stools, convulsions, coma. Give magnesium sulphate (full dose), demulcents, anodynes, stimulants.

*Allied Plants:*

1. *Juniperus virginiana*, Red Cedar.—The tops, official 1820–1880. United States. Slow-growing evergreen, 6–24 M. (20–80°) high, 15–45 Cm. (6–18') thick, branches spreading, horizontal near the ground, leaves small, glandular, ternate in pairs, only differs from *J. Sabina* in habit, smaller erect fruit, leaves more acute, interior wood reddish, durable, sapwood yellowish, branchlets bear excrescences (cedar apples, anthelmintic, dose, gr. 10–30 (.6–2 Gm.) ter die); odor of tops peculiar; taste pungent; contains volatile oil, resin, tannin. The wood gives volatile oil of red cedar, which contains cedrene camphor,  $C_{15}H_{26}O$ , + cedrene,  $C_{15}H_{24}$ . Both tops and volatile oil may be substituted for the official, but are weaker.

## CLASS 6: ANGIOSPERMÆ (Seeds clothed, enclosed in an ovary).

SUB-CLASS 1. MONOCOTYLEDONES (Embryo with one cotyledon, stem endogenous, leaves parallel-veined).

## 6. GRAMINACEÆ. Grass Family.

Gram-i-na'se-e. L. fem. pl. of *gramin-eus* + aceæ, of or pertaining to grass—*gramen*, grass. Herbs, shrubs, or arborescent plants, largest endogenous order except Orchidaceæ. Distinguished by having leaves 2-ranked with split sheaths and ligule; stems (culms) hollow, closed at joints; flowers glumaceous, paleæ (chaff, husk) 2, stamens 3, hypogynous; anthers versatile; ovary superior, ovule 1; fruit caryopsis, stigmas feathery, hairy; universal; purgative, poisonous, cereals, fodder, sugar, volatile oil.

Genera: 1. *Zea*. 2. *Saccharum*. 3. *Agropyron*.

## ZEA MAYS. INDIAN CORN.

1. ZEA. ZEA.

2. AMYLUM. STARCH, CORN STARCH.

*Zea* } 1. The fresh styles and stigmas.  
*Mays*, Linné. } 2. The starch grains obtained from the fruit.

**Habitat.** S. America; cultivated in warm temperate zones.

**Syn.** Corn-, Indian-, or Turkish-Corn, Maize, Mealies, Guinea or Turkey Wheat, Jagong, Corn-silk, Stigmata Maydis; Fr. Mais, Filament de Mais, Fécule (Amidon) de Maize; Ger. Mais, Maispistille, Amylum Tritici, Weizenstärke, Stärke, Kraftmehl, Maisstärke.

**Ze'a.** L. fr. Gr. ζῆα, to live—i. e., from its life-supporting properties to beast and man.

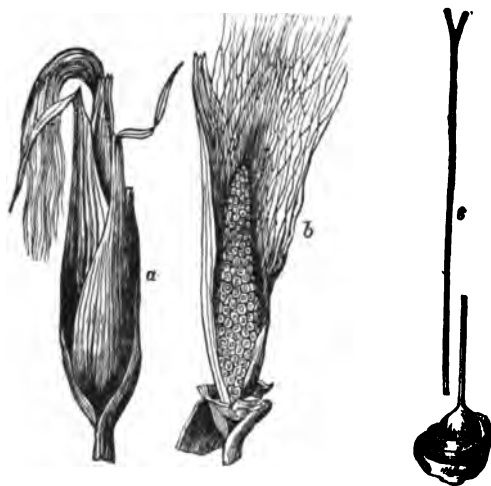
**Ma'ys.** L. *maydis*, Sp. *maiz*, fr. *mahiz*, its native name in the Haitian Island language, its native habitat.

**Am'y-lum.** L. starch, Gr. ἀμύλον = α, not, + μύλη, a mill—i. e., so fine as not requiring to be ground in a mill.

**Starch**, fr. *stark*, strong, stiff, so called from its use in stiffening various substances.

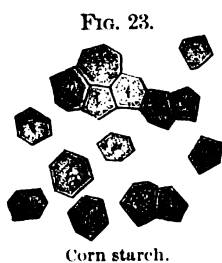
PLANT.—An annual; stem 1.2–4.5 M. ( $4-15^{\circ}$ ) high, erect, stiff, unbranched, grooved on one side, smooth, solid, with spongy centre, jointed; roots fibrous; leaves many, linear, .6–1 M. ( $2-3^{\circ}$ ) long, 5–7.5 Cm. ( $2-3'$ ) wide, channeled; the flowers monœcious—staminate spike-

FIG. 22.



*Zea Mays*: a, spadiceous flower with styles protruding; b, the same freed from cover leaves reduced in size; c, a single style with stigma.

lets numerous, in pairs, forming a long-stalked terminal panicle (tassel), —pistillate thick spikes, from the husks of which project long, slender styles and stigmas (silk); fruit, caryopsis (kernel) and the rachis (cob) form the spike (ear), which is enclosed by the bracts of the spathe (husks). Kernels (seed, grain) occur in 8–10–12 rows, or some even number = yellow, white, red, or purple color. STYLES AND STIGMAS



Corn starch.

(zea), a matted mass of slender filaments, thread-like, 5–15 Cm. ( $2-6'$ ) long, .5 Mm. ( $\frac{1}{50}'$ ) thick, yellowish or brownish; nearly inodorous; taste faintly sweetish with characteristic flavor. Solvent: boiling water. Dose, 3ss–2 (2–8 Gm.). STARCH GRAINS (starch), in fine powder or irregular, angular, white masses, easily powdered, inodorous, tasteless, insoluble in cold water, alcohol, ether; under microscope in nearly uniform granules, somewhat spherical, but usually polygonal (5–6–7) 0.010–0.025 Mm. ( $\frac{1}{2500}-\frac{1}{1000}'$ ) in diameter, two-thirds the size of wheat starch, indistinct striæ, and distinct slit-hilum near the centre; dried in warm air should show at least 95 p. c. hydrolyzable carbohydrate. Tests: 1. When boiled with water get white jelly having bluish tinge; this when cool becomes deep blue by adding iodine T. S. 2. With diluted acids or diastase get dextrin,  $C_{12}H_{20}O_{10}$ , dextrose,  $C_6H_{12}O_6$ , and water,  $H_2O$ , which reveals the starch formula to be  $(C_6H_{10}O_5)_n$ . Solvents: water or glycerin by boiling. Dose, 3ss–2 (2–8 Gm.).

## GRAMINACEÆ.

**ADULTERATIONS.**—Allied starches, especially of wheat, potatoes (white and sweet), yam, etc., all recognized by the microscope in the shape of the granules.

**Commercial.**—*Zea* is simply collected from the ears of corn and dried carefully in the sun. Starch is prepared from the grain by soaking in hot water, to which sometimes an alkali is added, until the testa are softened, then grinding under water and washing it upon large sieves with water; by this means the starch is suspended in the water and will deposit upon being allowed to remain undisturbed for some hours; the gluten when present remains in the supernatant alkaline water or upon the sieve. When all the starch is deposited on the bottom of the container (tank), the liquid is racked off, the starch cut into blocks and carefully dried in suitable chambers. The finely ground corn meal may also be kneaded under a stream of running water until milkiness ceases, then allowing the milky water to subside.

**CONSTITUENTS.**—I. *ZEA*: Maizenic acid 2.25 p. c., fixed oil (oleum maydis), resin, sugar, mucilage, salts.

**Maizenic Acid.**—Soluble in water, alcohol, ether; the oil is yellow, viscid, transparent, odor of corn meal, bland taste, demulcent.

II. **STARCH**:  $C_6H_{10}O_5$ , or a multiple of this, ash 1 p. c.

**PREPARATIONS.**—1. *Glyceritum Amyli*. Glycerite of Starch. (Syn., Plasma, Glycamyl; Br. Glycerin of Starch; Fr. Glycéré d'Amidon, Glycérat simple (d'Amidon); Ger. Unguentum Glycerini, Stärke-Glycerit.)

**Manufacture**: 10 p. c. Starch 10 Gm., water 10 Cc., glycerin 80; heat and stir until a homogeneous, translucent jelly is formed.

**Unoff. Preps.**: I. *ZEA*: *Fluidextract*, dose, ʒj-2 (4-8 Cc.). *Extract* (aqueous), dose, gr. 5-10 (.3-.6 Gm.). *Decoction*, 5 p. c., dose, ʒj-2 (30-60 Cc.). *Syrup*. Maizenic acid, dose, gr.  $\frac{1}{8}$  (.008 Gm.). II. **STARCH**: *Iodized Starch* (*Amylum Iodatum*) 95 p. c. + iodine 5, water q. s. for trituration; then dry; dose, ʒj-4 (4-15 Gm.).

**PROPERTIES.**—I. *ZEA*: Diuretic, lithontriptic, demulcent, anodyne, alterative, to disorders of genito-urinary passages and bladder.

II. **STARCH**: Nutritive, demulcent, protective, absorbent.

**USES.**—I. *ZEA*: Acute and chronic cystitis, uric acid and phosphatic gravel, gonorrhœa, cardiac stimulant in dropsy of heart disease.

II. **STARCH**: Mostly externally as a dusting-powder to allay itching and burning of the skin in erythema, urticaria, erysipelas, small-pox, to saturate bandages for fractures, as an injection for inflamed rectum or bladder, as a vehicle for enemata, to harden pills, antidote to iodine-poisoning. Owing to starchy foods fermenting they should be avoided in fermentative dyspepsia.

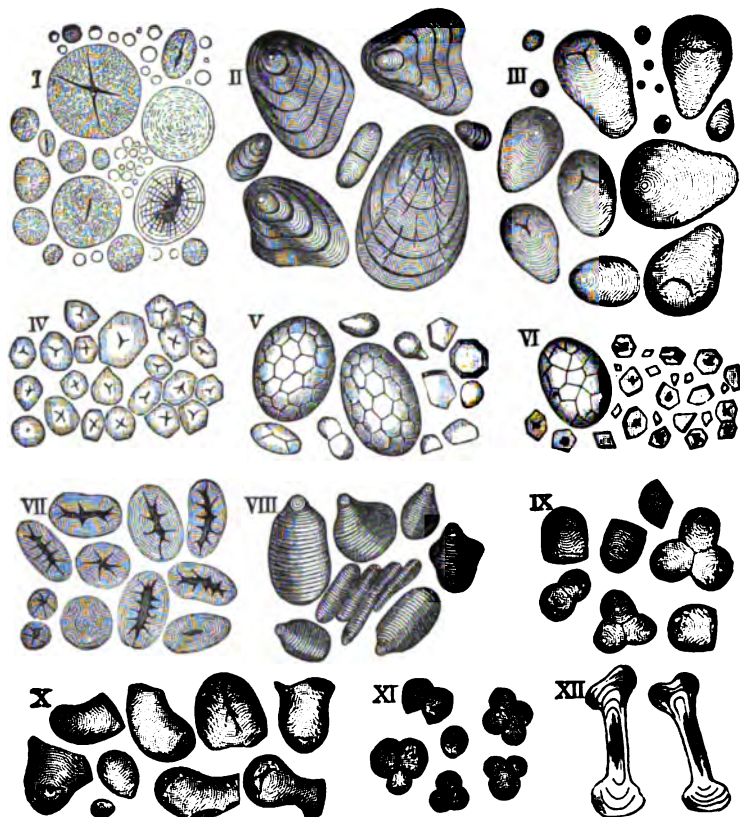
*Allied Starches:*

While the official starch is a product from corn, hence called corn starch, it should be borne in mind that there are many plants that also yield starch, but each kind peculiar to itself. This should not be accepted to infer total physical and chemical difference, because these in the main are uniform. It is only in the shape of the starch granules as viewed under a microscope that we recognize a varying form,



and that this is characteristic alone for the source whence derived. Thus, when given a starch or mixture of starches, a small portion moistened with water and viewed under high power readily reveals its origin by the various outline granules. In this way (from their contained starch) it is possible to distinguish many official roots, rhizomes, seeds, fruits, etc., as it is also the cereals, edible fruits, and vegetables.

FIG. 24.



Starch granules, magnified 475 diameters.

I. *Wheat Starch* (*Agropy'ron* (*Trit'icum*) *æsti'vum*). U. S. P. 1880. Lenticular, large and small granules, layers indistinct, hilum slight, near the centre.

II. *Potato Starch* (*Sola'num tubero'sum*). Ovate, granules unusually large, layers very distinct, hilum rather small and at the narrow end.

III. *Maranta Starch* (*Maran'ta arundina'cea*). Ovate granules, layers delicate, distinct, hilum at the broad end, often cleft.

IV. *Corn Starch* (*Ze'a Ma'ys*). Polyhedral granules, layers not easily distinguishable, hilum central, large.

V. *Oat Starch* (*Ave'na sati'va*). Polyhedral granules often united in ovoid masses (compound), layers and hilum indistinct.

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VI. *Rice Starch* (*Ory'za sati'va*). Polyhedral granules, uniform, similar but much smaller than corn starch, hilum very small.

VII. *Bean Starch* (*Phase'olus vulga'ris*). Ellipsoidal granules, layers distinct, crossed by fissures radiating from centre.

VIII. *Curcuma Starch* (*Cur'cuma lon'ga*, +). Elliptic granules, flat, contracted at one end; layers numerous, delicate, hilum small, at narrow end.

IX. *Tapioca*. *Brazilian Arrow-root* [*Man'ihot Manihot (utilis'sima)*]. *Cassava Starch*. Muller-shaped, layers indistinct, hilum near rounded end, often cleft.

X. *Sago*. *Pearl Sago* (*Metrox'ylon Rum'phii* and *M. Sa'gu*). Ovate granules, 1 end truncate, layers more or less distinct, hilum at rounded end, often cleft.

XI. *Sarsaparilla Starch* (*Smi'lax officina'lis*). Roundish, compound, usually with cleft hilum.

XII. *Euphorbia Starch* (*Euphorbiaceæ Plantæ*). Elongated, bone-shaped nodular ends, layers distinct.

*Derivative Product:*

1. *Dextrinum*, *Dextrin*,  $C_6H_{10}O_5$ . Obtained by heating starch  $204^{\circ}$  C. ( $400^{\circ}$  F.), in a cylinder or flat vessel; this yellowish product is often called in commerce *British Gum*. May also make it by heating starch  $110^{\circ}$  C. ( $230^{\circ}$  F.), with diluted nitric acid. It is a pale yellow, amorphous, gummy mass, soluble in water, insoluble in alcohol or ether.

SACCHARUM. SUGAR,  $C_{12}H_{22}O_{11}$ .

**Saccharum officinarum**, Linné,  
and various species or varieties of **Sorghum**  
and one or more varieties of **Beta vulgaris**,  
Linné.

} The refined sugar from these  
sources.

*Habitat*. S. Asia, cultivated in tropics and subtropics, Africa, E. and W. Indies, Cuba, Brazil, S. United States, especially Louisiana. The sugar beet in France, Germany; cultivated in Kansas, California, Nebraska, Utah.

*Syn*. Cane-sugar; Br. Saccharum Purificatum, Refined Sugar (Sucrose); Fr. Sucre, Sucre de Canne, Sucre pur; Ger. Zucker, Rohrzucker, Weisszucker.

**Sac'cha-rum**. L. sugar, Gr. σάκχαρον, fr. Ar. sukkar, Hung. zukur, ML. succarum after succus, a juice, fr. Skt. carkara, candied sugar, orig. grit, gravel.

**Of-fi-ci-na'rum**. L. officina, workshop—i. e., opus, work, + facere, to do, = of or belonging to the shop or store.

**Sor'ghum**. L. fr. sorghi, its native Indian name.

**Be'ta**. L. the beet, fr. Celtic bett, red—i. e., the red color of the roots.

**Vul-ga'ris**. L. ordinary, common—i. e., the kind most universally found wild.

**PLANTS**.—1. *Saccharum officinarum*, *Sugar Cane*. Perennial herb; rhizome thick, jointed, solid; roots fibrous; stems many, 2–4.5 M. (6–15°) high, 2.5–5 Cm. (1–2') thick, jointed, solid, containing white juicy pith, and, according to variety, outside yellow, greenish-yellow, purple, or striped, joints 7.5 Cm. (3') apart, giving rise to encircling leaves; leaves 1–1.2 M. (3–4°) long, 5 Cm. (2') wide, flat, acuminate, white midrib, longitudinally striate, dentate; flowers pinkish, in large terminal panicles. There are several varieties, all more or less resembling our Indian corn. It is cultivated by cuttings, planted in rows,

and, producing shoots readily, may yield some five or six crops before replanting.

2. *Sorghum vulgare* var. *saccharatum*, Broom Corn (Chinese Sugar Corn). Root annual with culm 2–3 M. (6–10°) high, 12–25 Mm.

FIG. 25.

*Saccharum officinarum*.

( $\frac{1}{2}$ –1') thick, smooth, solid with pith, nodes tumid; leaves .6 M. (2°) long, 5–7.5 Cm. (2–3') wide, linear, acuminate, pubescent at base; flowers in panicles.

3. *Beta vulgaris*, Common or Sugar Beet. Chenopodiaceæ. Herb with biennial fleshy root 7.5–10 Cm. (3–4') thick, 30–37.5 Cm. (12–15') long, conical, deep purple or yellowish; stem .6–1.2 M. (2–4°) high, paniculately branched; leaves—radical 15–30 Cm. (6–12') long, petioles 10–20 Cm. (4–8') long—cauline smaller as nearing apex; flowers July–Aug., axillary clusters.

SUGAR, white, dry, hard crystalline granules, sp. gr. 1.59, odorless, very sweet taste, permanent, soluble in 0.46 part water, 137.2 alcohol, 0.2 boiling water, insoluble in ether, chloroform, carbon disulphide; saturated aqueous solution (syrup) dextrogyrate with sp. gr. 1.340; by ferments in air or by boiling with diluted acids, syrup is converted into invert sugar (mixture glucose + levulose), which is then directly fermentable and reduces red cuprous oxide from alkaline solution of cupric oxide; kept for a time at 180° C. (356° F.) becomes converted into levulosane,  $C_6H_{10}O_5$ , and dextrose (glucose),  $C_6H_{12}O_6$ , without loss of weight. *Tests*: 1. Saturated solution upon long standing should not deposit sediment (abs. insoluble salts, ultramarine, Prussian blue). 2. 1 Gm. + 10 Cc. boiling water + 4–5 drops silver nitrate T. S. + 2 Cc. ammonia water, then quickly boiled, should have only slight coloration, no black deposit upon standing 5 minutes (abs. of glucose, and of more than slight amount of inverted sugar).

ADULTERATIONS.—Chiefly inferior sugars whitened with ultramarine or Prussian blue.

*Commercial*.—Cane-sugar was brought first from India to Europe by Venetians during the Crusades; was used by the ancients only as a medicine. With discovery of Cape of Good Hope and sea route to E. Indies, the Portuguese secured control of the sugar commerce, and thus its cultivation was extended to Arabia, Egypt, Sicily, Spain, Canaries, America, W. Indies. It is manufactured by cutting ripe cane off near the ground, or pulling up and washing beet roots stripped of leaves, and passing these through iron roller-presses in order to express the juice, which being run into shallow pans is

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boiled with lime (1 in 800); heat coagulates albumin, gluten, etc., which is skimmed off, lime neutralizes free acid and combines with albuminoids not coagulable by heat or acids, a part forming scum, the other a deposit. The thus clarified juice is drawn off into the boiler, evaporated, skimmed, and when sufficiently tenacious and granular is emptied into coolers to crystallize or grain. The concrete sugar is put into barrels with perforated bottoms, drained 3–4 hours or strongly agitated with wooden stirrers, causing granulation in 6 hours; it is yellow, and is now packed into hogsheads, being exported as *raw*, *open pan* or *muscovado sugar*, the drainings constitute treacle or molasses. This sugar is refined by dissolving in water with steam, heating with bullocks' blood, filtering through canvas bags, percolating through large cylinders of animal charcoal, and evaporating the colorless percolate in steam vacuum pans at 77° C. (170° F.). When sufficiently concentrated, it is run into conical moulds (centrifugals) having orifices closed; after solidification the stoppers are removed for draining (treacle), loaves are then sugared by pouring over them saturated syrup, which by slow infiltration passes through, carrying with it all coloring-matters, impurities, etc., without dissolving any crystallized sugar, thus giving *refined*, *vacuum pan*, or *loaf sugar*. Sugar may also be obtained from maple, birch, palm, etc.

**CONSTITUENTS.**—**SUGAR CANE:** Juice 80 p. c., which contains sugar 16–21 p. c., water 78–84 p. c., mucilage, resin, fat, albumin 0.3–0.4 p. c. **BEETS:** Juice contains sugar 9–19 p. c., but yields only about 9 p. c., being more difficult to obtain, owing to excessive quantity of proteids, etc.

**PREPARATIONS.**—1. *Syrupus*. Syrup. (Syn., Simple Syrup, Syrupus (Simplex) Sacchari; Fr. Sirop (de Sucre) simple; Ger. Syrupus simplex, Weisser Sirup.)

**Manufacture:** Sugar 85 Gm., dissolve by heat in distilled water q. s. 100 Cc. **Dose, ad libitum.** This should have sp. gr. 1.313, and contains 64.54 p. c. by weight of sugar.

**Preps.:** 1. *Compound or Medicated Syrups* of various kinds, as well as into numerous other preparations as an ingredient.

2. *Confectio Rosæ*, 64 p. c. 3. *Confectio Sennæ*, 55.5 p. c. 4. *Emulsum Amygdalæ*, 3 p. c. 5. *Massa Ferri Carbonatis*, 25 p. c. 6. *Mistura Ferri Composita*, 1.8 p. c. 7. *Pilulæ Ferri Carbonatis*,  $\frac{3}{4}$  gr. (.04 Gm.). 8. *Pilulæ Ferri Iodidi*,  $\frac{3}{4}$  gr. (.04 Gm.). 9. *Pulvis Cretæ Compositus*, 50 p. c. 10. *Pulvis Glycyrrhizæ Compositus*, 50 p. c. 11. *Tinctura Vanilla*, 20 p. c. 12. *Trochisci* (various kinds). 13. *Vinum Cocæ*, 6.5 p. c., etc.

**PROPERTIES.**—Demulcent, lenitive, stimulant, laxative, aliment, condiment, externally in certain ulcerations.

**USES.**—Chiefly as vehicle, corrigent, preservative, antiseptic, excipient. Syrups protect ingredients against putrefaction, not always against fermentation, prevent iron preparations from oxidation; in troches, powders and mixtures covers taste of nauseous medicines, rendering insoluble substances more miscible with water; in food nutrient

to adipose tissue, and a respiratory fuel; diuretic on healthy kidneys, has no effect on the teeth, good in cough, hoarseness, hiccough, aphthæ, ulcers, wounds, corneal and eyelid granulation, chronic laryngitis, chronic ozæna (as snuff), ascarides (by injection), fumes destroy offensive effluvia.

*Allied Products:*

1. *Glucose, Grape-sugar (Dextrose, Starch-sugar)*,  $C_6H_{12}O_6$ , or hydrated,  $C_6H_{12}O_6 \cdot H_2O$ . Obtained from grapes, also the kind that glucosides form when decomposed, but largely made by boiling starch 100 parts + water 400 + sulphuric acid 0.5–1.25 until starch can no longer be detected. The free acid is now neutralized with chalk, filtrate clarified, decolorized with clay, charcoal, etc., and concentrated in vacuum pan. Occurs in yellowish-white masses, crystallizes with or without water, inodorous, about one-half as sweet as cane-sugar, soluble in 1 part water, sparingly in alcohol, usually contains glucose 60 p. c., dextrin 20 p. c., water 20 p. c., ash 0.3 p. c., cold aqueous solution dextrogyrate; mixed with twice bulk alcohol get white precipitate if dextrin present; with ammonium oxalate get white precipitate of the calcium sulphate. Liquid glucose contains dextrose 34–43 p. c., maltose 0–19 p. c., dextrin 30–45 p. c., water 14–23 p. c. Diluted solutions in water easily ferment, when heated with potassium hydroxide are colored brown, speedily reduce red cuprous oxide from alkaline solution of cupric oxide, and separate a metallic mirror upon the addition of an ammoniacal silver solution; with heat get caramel. Used like cane-sugar; Syrupus Glucosi (Br.)—liquid glucose 25 parts, syrup 50.

2. *Fructose, Fruit-sugar (Levulose)*  $C_6H_{12}O_6$ .—This often accompanies grape-sugar in fruits, honey, etc., sometimes in plants with cane-sugar. It is usually a colorless uncrystallizable syrup, nearly as sweet as cane-sugar, levogyrate, soluble in water. May be produced from inulin by diluted acids; with nascent hydrogen yields mannite, with nitric acid is oxidized into succinic, acetic, and oxalic acids.

3. *Inosite, Phaseo-mannite*,  $C_6H_{12}O_6 \cdot 2H_2O$ .—Found in juices of some meats, green fruits (Leguminosæ), asparagus, etc.; it is very sweet, crystallizes from water, alcohol; does not ferment, but with nitric acid yields explosive compounds and oxalic acid.

4. *Syrupus Fuscus, Molasses (Melasses)*.—Official 1860–1870. Have two kinds: 1. W. India; black, ropy, peculiar odor, sweet, empyreumatic taste. Yields by fermenting and distilling commercial rum, and is the kind once official. 2. Sugar House (Golden Drips, Grocer's Syrup). Same as preceding, only thicker, different flavor, often largely adulterated with glucose, sp. gr. 1.40, contains solid matter 75 p. c. Both kinds have uncrystallizable sugar with some cane-sugar which failed to crystallize out; also have gum, coloring-matter. If these be boiled with a strong solution of potassium dichromate, get violent reaction, green liquid; but if adulterated with one-eighth starch-sugar molasses, the reaction is wanting, color not changed.

*Derivative Products:*

1. *Rock Candy, Saccharum Crystallizatum*.—Heat concentrated cane-

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sugar syrup, add spirit, and upon cooling, white, transparent, oblique, 4-sided prisms form; this is the purest kind of sugar.

2. *Barley-sugar, Saccharum Hordeatum*.—Cane-sugar melted carefully ( $185^{\circ}\text{C}$ .;  $365^{\circ}\text{F}$ .) and suddenly cooled; it is amorphous, yellowish, transparent, gradually becoming crystalline and opaque externally.

3. *Caramel, C<sub>12</sub>H<sub>18</sub>O<sub>9</sub>*.—This results from cane-sugar parting with  $2\text{H}_2\text{O}$  by being heated to  $204^{\circ}\text{C}$ . ( $400^{\circ}\text{F}$ .) for a short time; it is dark brown, bitter, consisting of colorless bitter caramelan,  $\text{C}_{12}\text{H}_{18}\text{O}_9$ , red-brown caramelene, and other compounds; conversion is hastened by alkalies. Used in coloring liquid preparations.

## TRITICUM. TRITICUM.

**Agropyron repens,** } The dried rhizome gathered in the spring.  
(*Linné*) *Beauvois*.

*Habitat.* Europe, N. America.

*Syn.* Couch-grass, Shelly-, Quack-, Quick-, Quitch-, Twitch-, Dog-, Witch (grass-), Knot-, or Dog's Tooth Grass, Quitch, Quickens, Dogweed, Chiendent; Fr. Chiendent officinal, Petit Chiendent; Ger. Rhizoma (*Radix*) Graminis, Queckenwurz, Grasswurz.

**Ag-ro-py'ron** (*Agropyrum*). L. fr. Gr. *ἀγρός*, a field, + *πυρός*, wheat—i. e., grows wild in wheat fields.

**Re'pens.** L. fr. *repo*, creep, crawl—i. e., stem inclines to crawl on the ground.

**Trit'i-cum.** L. fr. *tero, terere*, pp. *tritius*, thresh, rub, grind—i. e., seeds must be ground for eating.

**PLANT.**—Perennial weed along roadsides and in cultivated grounds; culm .6–1.2 M. ( $2\text{--}4^{\circ}$ ) high; spikes compressed, 7.5–10 Cm. ( $3\text{--}4'$ ) long; spikelets 3–8-flowered, 2-ranked, alternate on opposite sides of solitary, terminal spike; glumes transverse, lanceolate, herbaceous, 3–7-nerved; flowering glumes rigid, convex on back, 5–7-nerved, pointed or awned from tip; palea flattened, bristly ciliate. **RHIZOME**, very long, creeping, of horizontal growth, subcylindrical, 1–2 Mm. ( $\frac{1}{2}\text{--}\frac{1}{2}'$ ) thick, usually cut into sections 5–8 Mm. ( $\frac{1}{3}\text{--}\frac{1}{3}'$ ) long, brownish-yellow to straw-colored, nearly smooth, hollow in centre; odor slight; taste distinctly sweet. *Solvents*: cold or hot water. Dose, 3ss–3 (2–12 Gm.). —

**CONSTITUENTS.**—Triticin 8 p. c., fruit-sugar 2.5–3.5 p. c., inosite, glucose, mucilage, malates, ash; lactic acid and mannite are found in the extract as results of fermentation.

**Triticin.**—Gum-like substance resembling inulin, convertible into levulose. Obtained by exhausting with water, neutralizing with baryta, concentrating, precipitating with lead subacetate, removing lead, treating with charcoal, neutralizing, concentrating, precipitating with alcohol; it is an amorphous, white powder, inodorous, tasteless, deliquescent, with nitric acid oxidizes into oxalic acid.

FIG. 26.

*Agropyron repens.*

PREPARATIONS.—1. *Fluidextractum Tritici*. Fluidextract of Triticum. (Syn., Extractum Tritici Fluidum, U. S. P. 1890; Fr. Extrait liquide de (petit) Chiendent; Ger. Flüssiges Queckenwurzelextrakt.)

*Manufacture*: Exhaust 100 Gm. with boiling water by percolation, evaporate to 75 Cc., add alcohol 25; set aside 48 hours, filter. Dose, 5ss–3 (2–12 Cc.).

FIG. 27.



*Agropyron repens*: rhizome and transverse section, magnified 3 diam.

*Unoff. Preps.*: *Extract*, dose, gr. 10–20 (.6–1.3 Gm.). *Decoction*, 5 p. c., dose, *ad libitum*. *Infusion*, 5 p. c., dose, *ad libitum*.

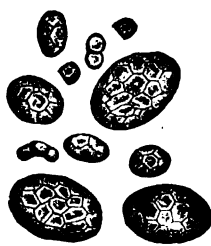
PROPERTIES.—Diuretic, aperient, demulcent, vulnerary.

USES.—Cystitis, irritable bladder, dysuria, gravel, jaundice, bronchitis, skin diseases, gout, relieves thirst, allays fever, promotes urination. Large and frequent drinks once considered a blood purifier.

*Allied Plants*:

1. *Ave'na sati'va*, *Avenæ Farina* (Oatmeal).—The meal prepared from the seed, official 1820–1880. Asia, Europe, cultivated. Plant .6–1.3 M. (2–4°) high, culm smooth, leaves linear, veined, rough, panicles loose, spikelets 2–3-flowered, paleæ (husk) cartilaginous. The

FIG. 28.



Oat starch: magnified 250 diam.

grain when ground yields oatmeal, if deprived of paleæ then have groats. Oatmeal is not uniform, but is yellowish-white, gluten and husk present, bitterish starch granules polyhedral, muller-shaped. Composed of husk 25 p. c., grain 75 p. c.; the former contains fixed oil 1–1.5 p. c., sugar and gum 0.25–0.75 p. c., proteids 2 p. c.; the latter starch 64–66 p. c., fat 5–7 p. c., proteids, 18–21 p. c. (mainly avenin), salts 1–3 p. c. Used as demulcent, laxative, dietetic, nutritive. The indigestible husks act as a mechanical irritant, exciting peristalsis, but may constipate by compaction. Given as porridge or gruel may ferment and impair digestion.

2. *Andropogon squarro'sa* (*murica'tus*), *Vetiveria* (*Vetiver*).—E. India. The fibrous wiry roots from the rhizome; yellowish-brown, waxy, 15–20 Cm. (6–8') long, 1 Mm. ( $\frac{1}{25}$ ') thick, tough, aromatic, balsamic; contains volatile oil, resin. Used as tonic, stimulant, in perfumery, sachet powders, etc.

3. *Sor'ghum vulga're*, *Broom Corn*.—Fruit 4 Mm. ( $\frac{1}{4}$ ') long, oval, flattened, brownish-yellow. Used in decoction (10 p. c.) for cystitis, etc.

## GRAMINACEÆ.

## MALTUM. MALT.

**Hordeum distichon**, Linné. } The grain of barley, partially germinated artificially and then dried.

*Habitat.* W. Asia, China, Egypt; cultivated.

*Syn.* *Hordeum Decorticatum* (Perlatum), *Maltum Hordei*, Barley Malt; Fr. Orge Perle, Malt d'Orge, Dreche; Ger. Perlgerste, Perlgrauen, Malz, Gerstenmalz.

**Hor-de-um.** L. barley, classical Latin name, fr. *horrere*, bristle—i. e., spikelets pointed with an awn, or of the bristle form.

**Dis'ti-chon.** L. fr. Gr. *δίστιχον*—*dis*, twice, two + *στίχον*, row—i. e., spike 2-sided, or grain arranged in two rows.

**PLANT.**—Annual grain, culm, .6–1 M. (2–3°) high, leaves 15–37.5 Cm. (6–15') long, linear, scabrous, spike 7.5–10 Cm. (3–4') long, fruit in 2 rows, seed elliptical, 8 Mm. ( $\frac{1}{3}$ ') long, flat back, angled sides, grooved front, smooth, grayish-yellow from adherent paleæ, when removed brownish; deprived of outer integuments (pericarp) gives "pot barley," and by partial grinding get "pearl barley," having the integuments and a portion of the kernel removed, and ends of seeds rounded off, producing grains 2.5–4 Mm. ( $\frac{1}{10}$ – $\frac{1}{6}$ ') long, and about as broad; contains starch 60–68 p. c., protein compounds (gluten, albumin) 12–16 p. c., oil 2–3 p. c., cellulose 8–12 p. c. **MALT**, yellowish or amber-colored grains, shading to brown, crisp when fractured, interior whitish or brownish, agreeable, characteristic odor, sweet taste, due to conversion of starch to maltose through action of diastase, floats on cold water. *Tests:* 1. Solid soluble constituents from evaporating aqueous infusion to dryness should be 70 p. c.; acidity, calculated as lactic acid, should not exceed 0.3 p. c. *Solvent:* cold water dissolves about 70 p. c.

*Commercial.*—Barley seed is soaked in water, placed in heaps, when heat is generated spontaneously, being prevented from rising too high by occasional turning; germination takes place, and when the germ (acrosipre) has acquired the proper length ( $\frac{1}{3}$  of grain), the grain is dried rapidly to kill the embryo, thereby arresting further action of diastase, hence conversion of starch to maltose, sprouts removed, and thus constitutes malt. According to degree of heat used in drying will be obtained the pale, pale-amber, or amber-brown varieties; the grain increases 9 p. c. in size, but loses 20 p. c. in weight, becoming soft and easily crumbled.

**CONSTITUENTS.**—Diastase 0.2–1 p. c., peptose (converts albumin to peptones), dextrose, sugar, starch.

**PREPARATION.**—1. *Extractum Malti*. Extract of Malt. (*Syn.*, Fr. *Extrait* (Essence) de Malt; Ger. *Malzextrakt*.)

*Manufacture:* Macerate for 6 days malt 100 Gm. in water 100 Cc., then add slightly warm (30° C.; 86° F.) water 400, digest for 1 hour

FIG. 29.



Barley starch.



at 55° C. (131° F.), strain, express, evaporate liquid on water-bath or in vacuum apparatus (55° C. ; 131° F.) to the consistency of thick honey ; yield 65–75 p. c. It is a brownish-yellow, thick or semi-fluid liquid, slight odor, sweet, mucilaginous taste, acid reaction, soluble in water, turbid, then flocculent precipitate with alcohol, tannin, alkaloidal reagents, mercuric chloride, gradually liquefies starch-paste, which will not become blue with iodine ; contains water 20–25 p. c., maltose 48–70 p. c., dextrin 2–16 p. c., diastase 1–2 p. c., proteids 8 p. c., phosphoric acid 0.3–0.4 p. c., lactic acid 0.75–1.5 p. c., ash 1.5 p. c. Should be kept cool, in well-closed containers. Dose, ʒj–4 (4–15 Gm.).

**PROPERTIES AND USES.**—**Barley** : As a nutritive in bronchial affections, sore throat, febrile diseases, pulmonary and urinary disorders ; **Malt** : Yields to cold water its active constituents (diastase 0.2–1 p. c., dextrin, sugar, starch), producing an infusion or wort which by adding hops and fermenting gives several kinds of malted liquors (ale, porter, lager beer, brown stout, etc.)—infusion may be used in wasting diseases, cholera infantum, diarrhoea ; **Extract** : Good for dyspepsia, phthisis, wasting diseases, as an emulsifying agent, as a basis for cod-liver oil emulsion ; dry extract as food for infants.

## 7. PALMACEÆ. Palm Family.

**Pal-ma'se-e.** L. *Palm-a* + *aceæ*, fem. pl. *palmaceous*, of or pertaining to the palms, fr. *palma*, a palm. Perennial trees or shrubs, mostly unbranched, growing by terminal, or edible bud. Distinguished by leaves being palmately or radiately parallel-veined, plaited, on sheathing petioles, somewhat divided on expansion ; flowers small, perfect or polygamous, regular, often rigid or fleshy, frequently dioecious ; perianth double, 3-merous, stamens 6, borne on branching spadix ; ovary and style 3 ; fruit berry, drupe or dry ; seed 1–3 ; embryo minute, albuminous ; tropical climates ; diuretic, expectorant, sedative, tonic ; timber valuable in ships.

Genus : 1. **Sabal.**

## SABAL. SABAL.

**Serenoa**  
**serrulata**, (*Roemer et Shultes*) *Hooker filius.* } The partially dried ripe fruit.

*Habitat.* S. United States (N. Carolina to Florida) ; sandy soil near seacoast.

*Syn.* Saw-palmetto, Palmetto, Dwarf Palmetto, Fan Palm.

**Sa'bal.** L. fr. S. American or Mexican native name.

**Se-re'no-a.** L. after Professor Sereno Watson, a noted American<sup>1</sup> botanist and author.

**Ser-ru-la'ta.** L. fr. *surrulatus*, *serrula*, dim. of *serra*, a saw—i. e., leaves have marginal notches like saw-teeth.

**PLANT.**—Small, low, shrub ; stem (caudex) creeping ; rhizome many feet long, 10–15 Cm. (2–4') thick, running horizontally several feet

**PALMACEÆ.**

under the surface; roots numerous, fibrous, 1.5–3 M. ( $5-10^{\circ}$ ) long, 12 Mm. ( $\frac{1}{2}$ ') thick; leaves .6–1 M. ( $2-3^{\circ}$ ) long, in dense masses, flabelliform, 10–12-cleft, petioles aculeate-serrate or spiny-edged; flowers small. **FRUIT**, a 1-seeded drupe, similar to olive, irregularly spherical to oblong-ovoid, 10–25 Mm. ( $\frac{2}{5}-1'$ ) long, 10–15 Mm. ( $\frac{2}{5}-\frac{3}{8}'$ ) broad, blackish-brown, shriveled, somewhat oily, epicarp thin, sarcocarp 1 Mm. ( $\frac{1}{25}$ ') thick, greenish-yellow, soft, spongy, endocarp thin, friable, seed hard, chocolate-brown; odor aromatic; taste sweetish, acrid, oily. *Solvents*: alcohol, ether. Dose, gr. 15–60 (1–4 Gm.).

FIG. 30.



Saw-palmetto: fruit and seed.

*Commercial*.—Plant grows with greater exuberance near the sea, from Mosquito Inlet to Jupiter Inlet, Florida, where it forms an unbroken scrub a hundred (160 Km.) or more miles in length and several in breadth; the dense leaves with their saw-like edges render the jungles almost impenetrable by beast and man. The fruit ripens Oct.–Dec., and collection begins in August, before maturity, lasting until Jan.; after the fruit-stems are cut with pruning-shears, the fruit is shaken into baskets, a bushel weighing, when fresh, 54 pounds (25 Kg.), and when dried 30–40 pounds (13.5–19 Kg.). These are then placed in barrels and preserved for use by adding thereto a small amount of alcohol.

**CONSTITUENTS**.—Volatile oil 0.5–1 p. c., Fixed oil 12–15 p. c., fat, alkaloid, resin, dextrin, glucose; seeds contain fixed oil 12 p. c.

**Volatile Oil**.—Not supposed to exist in the dried fruit; some claim it to be present in the recent fruit, others that it is formed by the slow action of the fatty acids on the alcohol in which the fruit is kept. It has a green color and an old-cheese odor.

**Fixed Oil**.—Thought to be composed of 2 portions, one being of a light lemon color, the other a greenish-brown; when combined has sp. gr. 0.885–0.914, congeals at  $11.5^{\circ}$  C. ( $53^{\circ}$  F.), melts at  $19.5^{\circ}$  C. ( $67^{\circ}$  F.).

**PREPARATIONS**.—(Unoff.) *Fluidextract* (alcohol), dose, 3ss–1 (2–4 Cc.). *Tincture*, 20 p. c., dose, ʒj–2 (4–8 Cc.). *Inhalation*—mix alcoholic solution with boiling water and inhale the vapor.

**PROPERTIES**.—Sedative, diuretic, expectorant, nutrient, tonic, anti-catarrhal. Improves digestion, induces sleep, increases flesh, weight, and strength.

**USES**.—Chronic bronchitis, phthisis, cold in the head, whooping-cough, irritated mucous membrane of the throat, nose, and larynx, cardiac asthma, diseases of glands of reproductive organs (mamms, ovaries, prostate, testes).

*Allied Plants*:

1. *Metroxylon Rum'phii* (*Sa'gus Rum'phii*), *Pearl Sago*.—The prepared fecula, official 1820–1880. E. India Islands, Borneo, Moluccas,

etc. Medium-size palm, 6–9 M. (20–30°) high, stem thick, covered with leaf-stalk remains, many pinnate leaves at apex; fruit round nut, covered with an imbricate coat, 1-seeded. The stem centre contains medullary matter like elder pith, which is obtained by felling and splitting the tree trunk, washing pith to extract the starch, which may be powdered, forming sago meal, or granulated. Each tree yields 500–600 pounds (225–270 Kg.) of sago. Pearl sago is the best, in pearl-like grains, brownish, diaphanous, unaltered granules oblong, truncate, muller-shaped, layers distinct, hilum at rounded end often cleft; common sago (*M. Sa'gu*) is larger grained. Used as demulcent, nutrient for sick with weak digestion, fevers; it is easily digested, non-irritating, prepared by boiling 1 part in water 32, straining, flavoring. Factitious sago is made from potato starch.

2. *Dæmon'orops* (*Cal'amus*) *Dra'co*, *Draconis Resina* (*Dragon's Blood*).—Borneo, Sumatra. A spontaneous resinous exudation from the ripening fruit; occurs in tears, globular pieces 4 Cm. (1½') thick, cylindrical sticks 3 M. (12') long, or in irregular cakes, dark brown, inside bright red, fracture dull, irregular, inodorous; when heated aromatic like benzoin, tasteless; contains red resin (draconin), benzoic acid or cinnamic acid, or both wanting, dracoresinotannol, dracoresin, dracoalban, ash 8–9 p. c.; mild stimulant, astringent. Used in tooth powders, plasters, varnishes.

3. *Ar'eca Cat'echu*, *Areca Nut*.—East Indies. Cultivated. Large palm tree 15–18 M. (50–60°) high, fruit orange-colored, size of hen's egg, contains 1 seed (nut), roundish, conical, 25 Mm. (1') long, 9 Mm. (⅓') thick, brown, with many reddish veins, inside horny, white, odor faint, taste astringent; contains fat 14 p. c.,

FIG. 31.

*Metrozylon Rumphii*.

FIG. 32.



Sago starch.

tannin, resin, arecoline,  $C_8H_{13}NO_2$  (poisonous, tæniifuge), arecaine, guvacine; astringent, tæniifuge. Dose, ʒij–3 (8–12 Gm.).

4. *Elæ'is guineen'sis*, *Oleum Palmæ* (*Palm Oil*).—W. Africa. Heat fruit with water and express. It is a solid fat, harder than butter, orange-red, bleached by light and heat, violet odor, bland taste, fuses

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at 27° C. (81° F.), upon keeping acquires rancid odor and lighter color ; demulcent. Used in ointments, but mostly in soaps and candles.

FIG. 33.



*Areca Catechu.*

5. *Co'cos nucifera*, *Oleum Cocois* (Cocoanut Oil).—Tropics. A fixed oil expressed from palm seeds after being boiled with water ; yield 50–60 p. c. ; it is a white solid, consistence of butter, odor disagreeable, soon becoming rancid ; demulcent. Mostly used in soaps.

**8. ARACEÆ. Arum Family.**

A-ra'se-e. L. *Ar-um* or *aron* + *aceæ*, Gr. *ἄρον*, the wake robin, Egyptian word. Herbs or shrubs. Distinguished by acrid, pungent juice, poisonous, having tubers, corms, or rhizomes ; leaves often veiny, petioled ; flowers perfect or diœcious, spadix within spathe, no perianth ; fruit succulent, terra or marsh plants ; tropics, temperate climates ; aromatic, stimulant, expectorant, antispasmodic, diaphoretic, starch, food.

Genus : 1. *Acorus*.

**CALAMUS. CALAMUS.**

*Acorus*  
*Calamus*, Linné. } The unpeeled, dried rhizome.

*Habitat.* N. America, Europe, W. Asia, swampy places, along ditches, streams, ponds ; cultivated in Burmah, Ceylon.

*Syn.* Sweet Flag, Sweet or Grass Myrtle, Myrtle Flag, Sweet Cane, Sweet Grass, Sweet Root, Sweet Rush, Sweet Cinnamon, or Sea Sedge, *Radix Calami Aromatici*, *Radix Acori*, *Calamus Root* ; Fr. *Acore vrai*, *Acore odorant* ; Ger. *Rhizoma Calami*, *Kalmus* (wurzel.)

**Ac'o-rus.** L. fr. Gr. *a*, priv. + *κόρη*, the pupil of the eye—i. e., originally thought to cure eye troubles.

**Cal'a-mus.** L. fr. Gr. *κάλαμος*, a reed, cane (L. *culmus*), fr. Ar. *kalam*, a reed—i. e., its leaves or scapes are cane- or reed-like.

**PLANT.**—Perennial herb ; leaves resembling those of the blue flag, *Iris versicolor*, 1–1.3 M. (3–4°) long, 2.5 Cm. (1') wide, sword-like, equitant ; flowers May–June, in spike 5–10 Cm. (2–4') long. **RHIZOME**, .6–1 M. (2–3°) long, 1–2 Cm. ( $\frac{2}{5}$ – $\frac{4}{5}$ ') thick, of horizontal growth, usually in longitudinally split pieces ; when entire, cylindraceous, some-

what flattened, reddish- or yellowish-brown, longitudinally wrinkled, annulate from remnants of leaf-sheaths ; upper surface with triangular, often fibrous leaf-scars, lower surface with circular pitted scars of roots ; fracture short, sharp, corky, spongy, whitish, showing numerous oil-cells and scattered fibro-vascular bundles, the latter crowded within the endodermis ; odor aromatic ; taste pungent, bitter. *Solvents* : alcohol ; hot water partially. Dose, gr. 15–60 (1–4 Gm.).

FIG. 34.

*Acorus Calamus.*

*Commercial.*—The rhizome is taken from the mucky earth by grubbing and pulling ; it is then washed, freed from roots, and dried with moderate heat, by which it shrinks one-half its diameter, but the odor and taste thereby become improved. In Germany rhizomes are often peeled before drying, thus giving a weaker product, owing to the fact that most of the volatile oil receptacles are in the cortex. Germany, Russia, England, United States, and India furnish the markets, that coming from the latter having the claim of being stronger and more aromatic. It should be collected in the spring, and deprived of the bitter and less aromatic roots, which are 10–15 Cm. (4–6') long, unbranched and tipped with soft thin fibres ; it loses on drying 75 p. c., deteriorates by age, often becoming attacked by worms.

*CONSTITUENTS.*—Volatile oil 1.5–3.5 p. c., Acorin 0.2 p. c., choline (calamine), soft resin, gum, starch.

*Volatile Oil (Oleum Calami).*—Obtained by distillation, has brownish-yellow color, aromatic odor, sp. gr. 0.965, contains pinene,  $C_{10}H_{16}$ , and a sesquiterpene, crystalline constituent,  $C_{15}H_{26}O_2$ , a body having the composition  $C_{10}H_{16}O$ , a high boiling fraction of a bluish color, and a small quantity of a phenol.

*Acorin*,  $C_{36}H_{60}O_6$ .—Glucoside, yellowish-brown, honey-like liquid. Obtained from a concentrated decoction by precipitating it successively with alcohol, lead acetate and subacetate, removing lead by hydrogen

**ARACEÆ.**

sulphide, neutralizing with sodium hydroxide and agitating with ether. It is resinous, neutral, very bitter, aromatic, soluble in alcohol, chloroform, ether, precipitated from hydrochloric acid solution by tannin, in a current of hydrogen may split into sugar and the volatile oil, but acted upon in the presence of air oxidizes to *acoretin*, a neutral resin, which by reduction in alkaline solution yields sugar and the volatile oil.

**PREPARATIONS.**—1. *Fluidextractum Calami*. Fluidextract of Calamus. (Syn., *Extractum Calami Fluidum*, U. S. P. 1890; Fr. *Extrait liquide d'Acore vrai*; Ger. *Flüssiges Kalmuswurzelextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv-60 (1-4 Cc.).

FIG. 35.



*Acorus Calamus*, rhizome: a, under surface; b, upper surface.

*Unoff. Prep.*: *Tincture*, 20 p. c. (alcohol), dose, ʒj-2 (4-8 Cc.). *Extract* (alcohol 40 p. c.), dose, gr. 2-8 (.13-.5 Gm.). *Infusion*, dose, ʒj-2 (30-60 Cc.).

**PROPERTIES.**—Stimulant, carminative, tonic, bitter, aromatic.

**USES.**—Dyspepsia, colic, flatulency, typhoid condition, coughs, flavoring. In India also used as an insectifuge, for fleas, etc. The Turks use the candied rhizomes as a preventive against contagion.

The *Κάλαμος αρωματικός* of Dioscorides was a different plant from this, being possibly one of the *Andropogons*.

*Allied Plants*:

1. *Arise'ma* (*A'rum*) *triphyllum*, *Indian Turnip*.—The cormus, official 1820-1870. N. America. Plant acaulescent, leaves 2, 3-divided, 5-17.5 Cm. (2-7') long, 2.5-7.5 Cm. (1-3') wide. Corm 2.5-5 Cm. (1-2') broad, brownish-gray, inside white, mealy, taste burning, acrid; contains volatile acrid principle, starch, fat, gum, resin, calcium oxalate (gives acidity). Used as stimulant, expectorant, diaphoretic, irritant for colic, flatulence, asthma, whooping-cough, chronic catarrh, rheumatism, bronchitis, aphthous sores, ringworm; in honey, syrup, ointment. Dose, gr. 5-15 (.3-1 Gm.).

2. *Spathye'ma* (*Symplocar'pus*) *fœ'tida*, *Skunk Cabbage*.—The dried rhizome and roots, official 1820-1880. Perennial, spathe appears first in spring, covered with purplish spots and stripes, flowers dull purple,

leaves .3-.6 M. (1-2°) long, .3-.4 M. (12-15') wide. Rhizome obconical, truncate, 7.5-10 Cm. (3-4') long, 5 Cm. (2') thick. Many rootlets, brownish-gray, inside whitish, many wood-bundles, whole plant fetid, more so when triturated, taste acrid, biting; contains volatile oil, gum, fat, resin, starch. Emetic, diuretic, antispasmodic, stimulant, narcotic; for asthma, chronic catarrh, rheumatism, chorea, hysteria, dropsy, bronchitis, in infusion, tincture. Dose, gr. 5-15 (.3-1 Gm.).

3. *Epiprem'num mirab'ile* (*Rhaphidoph'ora vitien'sis*—Araceæ), and *Prem'na traiten'sis*, *Tonga*.—Verbenaceæ. Fiji Islands. The mixed bark contains tongine (volatile alkaloid), volatile oil. Anodyne; neuralgia, rheumatism, in combination with salicylates. Dose, gr. 15-60 (1-4 Gm.).

### 9. MELANTHACEÆ. Bunch-flower Family.

Me-lan-tha'se-e. L. *Melanth-ium* + aceæ, fr. Gr. μέλας, black, + ἄνθος, flower—i. e., alluding to the darker color which the persistent perianth assumes after blossoming. Leafy-stemmed herbs. Distinguished by being rarely bulbous; leaves grass-like, parallel-veined with transverse veinlets; perianth 6, stamens 6, ovary 3-celled, superior; fruit capsule, septicidal; seeds tailed or appendaged: temperate climates; sedative, diaphoretic, sternutatory, poisonous.

Genera: 1. *Veratrum*. 2. *Asagræa*.

### VERATRUM. VERATRUM.

*Veratrum* { *viride*, *Aiton*, } The dried rhizome and roots.  
                  { *album*, *Linné*. }

*Habitat*. 1. N. America, Canada to Georgia, in rich, wet woods, swamps. 2. Europe, Alps, Pyrenees, Balkans.

*Syn*. 1. *Veratrum Viride*, U. S. P. 1890, American Hellebore, American White Hellebore, Green-, Swamp-, or False *Veratrum* or Hellebore, Devil's Bite, Duckretter, Poke Root, Indian Poke (their ordeal poison), Earth Gall, Tickle or Itch Weed (to bare-legged boys), Bugbane; Br. *Veratri Viridis Rhizoma*; Fr. *Vératre vert*; Ger. Grüner Germer. 2. White Hellebore, White *Veratrum*, Lingwort, Sneezewort, Neezewort; Fr. *Hellébore blanc*, *Vératre blanc*; Ger. *Weisse Niesswurz*, *Weisser Germer*.

*Ve-ra'trum*. L. *vere*, truly, + *ater*, black, dark—i. e., the color of the roots of some species.

*Vir'i-de*. L. *viridis*, green—i. e., flowers are greenish.

*Al'bum*. L. *albus*, white—i. e., flowers, rhizome, and roots slightly whiter than those of other species.

PLANTS.—Large perennial herbs, both identical except climatic and soil differences; stems annual, .6-2 M. (2-7°) high, stout, cylindrical, solid, nearly smooth, pale green, unbranched except in the inflorescence; leaves 12.5-20 Cm. (5-8') long, oblong, acuminate, sheathing the stem, plaited, nerved, pubescent; flowers May-July, many polygamous, nearly sessile, greenish-yellow, racemes with downy peduncles, sepals petaloid; fruit of 3 nearly distinct follicles 2.5 Cm. (1') long, pericarp

**MELANTHACEÆ.**

dry, brown, ventral dehiscence; seed flat, about 12 in each carpel.  
RHIZOME, upright, ovoid or obconical, 2.5–7 Cm. (1–3') long, 2–5 Cm.

FIG. 36.



*Veratrum viride*: a, root; b, flower; c, ovary; d, plant at its early age.

( $\frac{1}{2}$ –2') thick, light to dark brown or blackish, often coarsely fibrous remains of leaf bases at summit, internally grayish or yellowish-white, showing many short irregular wood-bundles; roots from all sides of



rhizome, numerous, shriveled, whitish or light yellowish-brown, 10–20 Cm. (4–8') long, 1–2 Mm. ( $\frac{1}{25}$ – $\frac{1}{12}$ ') thick; inodorous, strongly sternutatory when powdered; taste bitterish, very acid. *Solvent*: alcohol. *Dose*, gr. 1–4 (.06–.26 Gm.).

FIG. 37.



Veratrum album.

**ADULTERATIONS.**—Rhizome of allied plants, also those of *Spathyema* (*Symplocarpus*) *foetida*.

**Commercial.**—The rhizome is collected mainly in autumn or sometimes just before flowering, and owing to deteriorating should not be kept more than a year; after being dug it is washed and either dried whole or variously sliced.

**CONSTITUENTS.**—Protoveratrine 0.03 p. c., Jervine 0.1 p. c., Rubijervine 0.005 p. c., Pseudojervine, Protoveratridine (decomposition product), veratramarin (bitter glucoside), jervic acid, fat, resin, gum, starch; veratroidine and veratralbine are probably only mixtures of amorphous bases; cevadine only in *V. viride*.

**Protoveratrine**,  $C_{32}H_{51}NO_{11}$ .—Most important; white shining crystals, soluble in chloroform, hot alcohol; solution greenish with  $H_2SO_4$ , changing to blue, violet.

**Jervine**,  $C_{26}H_{37}NO_3$ .—Most abundant; white crystals, tasteless, non-sternutatory, slightly toxic, soluble in alcohol, acetone, chloroform.

**Rubijervine**,  $C_{26}H_{43}NO_2 + H_2O$ .—White prisms, distinguished from jervine by the ready solubility of its nitrate and sulphate; almost inert.

**Pseudojervine**,  $C_{29}H_{43}NO_7$ .—White crystals, soluble in alcohol; almost inert.

**PREPARATIONS.**—1. *Fluidextractum Veratri*. Fluidextract of Veratrum. (Syn., Extractum Veratri Viridis Fluidum, U. S. P. 1890; Fr. Extrait liquide de Vêratre amêricain; Ger. Flüssiges Grüngermer-extrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. *Dose*,  $\mathfrak{Mj}$ –4 (.06–.26 Gm.).

2. *Tinctura Veratri*. Tincture of Veratrum. (Syn., Tinctura Veratri Viridis, U. S. P. 1890; Tincture of Green (American) Hellebore; Fr. Teinture de Vêratre vert; Ger. Grün Nieswurzel-tinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with alcohol q. s. 100 Cc. *Dose*,  $\mathfrak{Mij}$ –10 (.13–.6 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.008–.016 Gm.). *Dr. Norwood's Tincture*, 50 p. c., saturated, being the same strength as the official tincture of 1870, dose,  $\mathfrak{Mv}$ –8 (.3–.5 Cc.).

**PROPERTIES.**—Sedative, emetic, diaphoretic, irritant, sternutatory,

**MELANTHACEÆ. •**

**errhine.** This resembles aconite very closely in action, being a cardiac depressant and spinal paralyzant. It diminishes the frequency and force of cardiac contractions, by depressing heart muscle, and stimulating inhibition (pneumogastric), depresses spinal cord, causing muscular relaxation, induces cutaneous relaxation, hence free sweating; large doses produce rapid but very feeble pulse, cold clammy skin, vomiting, debility, giddiness, impaired vision, partial unconsciousness; it is eliminated by the bowels. Jervine causes the chief action of the heart, lowers arterial tension by depressing the heart, depresses powerfully the vasomotor centre; protoveratrine slows the pulse by its powerful stimulating influence upon the pneumogastric; the so-called veratroidine depresses the cord, paralyzes respiration, and causes emetocatharsis, thereby often preventing fatal results.

**USES.**—To reduce arterial excitement, spinal spasms, pneumonia, cardiac diseases, typhoid fever. Always given in the commencing or inflammatory stages, heart disease, nervous palpitation, puerperal and epileptiform convulsions, tetanus, chorea, mania-a-potu, diphtheria.

*Poisoning, Incompatibles, Synergists:* Same as for aconite.

**SABADILLA. CEVADILLA.**

**Veratrina. Veratrine, official.**

**Asagraea officinalis,** } A mixture of alkaloids obtained from the seed.  
*Schlechtendal et Chamisso.*

*Habitat.* Mexico to Guatemala and Venezuela.

*Syn.* Indian Barley-caustic; Fr. Cévadille; Ger. Sabadillsamen, Läusekörner, Veratrinum, Veratrin.

**A-sa-græ'a.** L. after Asa Gray, formerly professor of botany, Harvard University.

**Of-fi-ci-na'lis.** L. *officina*, a workshop, = *opus*, work, + *facere*, to do, to make—i. e., used in or belonging to the shop or store.

**Sab-a-dil'la.** L. fr. *cevadilla*, *cebadilla*, fr. *cibare*, to feed, *cibus*, food.

**PLANT.**—This is a bulbous herb, bulb ovoid, covered with numerous black scales; scape 1.2–1.5 M. (4–5°) high; leaves from bulb, linear, grass-like, .3–1.3 M. (1–4°) long, smooth, entire, strong midrib; flowers numerous, 12 Mm. ( $\frac{1}{2}$ ') wide, monœcious, lower ones hermaphrodite; upper staminate, greenish-yellow, racemes, 22.5–45 Cm. (9–18') long; fruit composed of 3 dry follicles 12 Mm. ( $\frac{1}{2}$ ') long, pericarp pale brown, papery, dehiscent. Seeds 2–5 in each follicle, dark brown, fusiform, compressed, 6 Mm. ( $\frac{1}{4}$ ') long, slightly winged above, angular, testa thin, rugosely wrinkled, albumin whitish, oily, inodorous, bitter, acrid, sternutatory. Dose, gr. 1–4 (.06–.26 Gm.).

**Commercial.**—Sabadilla seeds are not now supposed, as formerly, to come from *Veratrum Sabadilla*, but mostly from *Asagraea officinalis* (*Schænocaulon officinale*, *Veratrum officinale*, *Helo'nias officinalis*). They at one time came solely from Vera Cruz, being derived from cultivated Mexican plants, but are now shipped chiefly from La Guayra, the port of Caracas, and Venezuela: the ripe capsules from Mexico.

CONSTITUENTS.—Veratrine (Cevadine,  $C_{32}H_{49}NO_9$  + Veratridine,  $C_{37}H_{53}NO_{11}$ ), cevadilline,  $C_{34}H_{53}NO_9$ , sabadine,  $C_{29}H_{51}NO_8$ , sabadinine,  $C_{27}H_{43}NO_8$ , angelic acid,  $C_5H_8O_2$ , methyl-crotonic acid,  $C_5H_8O_2$ , cevadic acid, veratric acid, fixed oil, ash 3.5 p. c.

FIG. 38.



*Asagracea officinalis*: a, fruit-bearing stem; b, root, bulb, and leaves.

**Veratrina.** Veratrine,  $C_{37}H_{53}NO_{11}$ .—This mixture of alkaloids is obtained by exhausting seed with alcohol, evaporating to syrup, adding water to get rid of resin, oil, etc.; the filtrate, containing veratrine veratrate, is precipitated

FIG. 39.



*Sabadilla*: a, fruit, natural size; b, seed and longitudinal section, magnified.

with ammonia in excess. Another method is to boil alcoholic extract in acidulated water ( $HCl$  or  $H_2SO_4$ ), decompose with magnesium oxide, take up alkaloids with acidified alcohol, evaporate, filter through charcoal, precipitate with ammonia. Commercial or medicinal veratrine usually consists of veratrine, cevadine (most important, sternutatory, with potassium hydroxide splitting into methyl-crotonic acid and amorphous cevine,  $C_{27}H_{43}NO_8$ ), veratridine, cevadilline (amorphous, insoluble in ether, benzene) sabadine (non-sternutatory, crystallizes from ether in needles and, like the preceding alkaloids, is colored yellow, then red by sulphuric acid), sabadinine (resembles sabadine, but turns red at once with sulphuric acid), and their derivatives. It is a white, or 'grayish-white, amorphous powder, odorless, causing irritation and sneezing; acid taste, leaving tingling and numbness to tongue, soluble in 1,750 parts water, 2.2 alcohol, 3 ether, 1 chloroform, no residue. *Tests*: 1. Triturated with sulphuric acid gives yellow or orange-red solution, which by reflected light has greenish fluorescence, intensified by additional acid, upon standing assumes deep red. 2. Heated with sulphuric acid gives cherry-red color; sulphuric acid with trace selenous acid gives brownish-green; sulphuric acid and sugar produces green, blue, finally colorless. Dose, gr.  $\frac{1}{32}$ – $\frac{1}{12}$  (.002–.005 Gm.).

PREPARATIONS.—1. *Oleatum Veratrinæ*. Oleate of Veratrine. (Syn., Veratrinum Oleicum; Fr. Oléate de Véatrine; Ger. Oelsaures Veratrin, Veratrinoleat.)

*Manufacture*: 2 p. c. Triturate veratrine 2 Gm. with olive oil 5 Cc., warm mortar, add oleic acid 50 Gm., stir until veratrine dissolved, add olive oil q. s. 100 Gm. Used externally.

2. *Unguentum Veratrinæ*. Veratrine Ointment. (Syn., Fr. Pomade de Véatrine; Ger. Veratrin salbe.)

**LILIACEÆ.**

**Manufacture:** 4 p. c. Veratrine 4 Gm., expressed oil of almond 6, benzoinated lard 90, mix thoroughly. Used externally.

**PROPERTIES.**—Sedative, powerful irritant, sternutatory, errhine. Locally—gives heat, pain, redness, numbness. Internally—causes burning sensation, free salivation, great depression, reduces force and rate of pulse; large doses make the contractions few, each lasting a long time, until heart stops in systole. When poisoned, have muscular weakness, nausea, vomiting, purging, debility, giddiness, impaired vision, partial unconsciousness, violent convulsions, muscular paralysis, seldom kills, if so, from heart paralysis.

**USES.**—Chiefly externally—neuralgia, headache, sciatica, pruritus, pediculi, acute articular rheumatism, pneumonia, epilepsy, chronic swellings, stiff, indurated sprains. For these it may be applied in fat or alcohol (1–5 p. c.), using gr. 2–4 (.13–.26 Gm.) per day, but never on abraded surface. Internally—for heart trouble, cardiac dropsies, gout, rheumatism, fevers, inflammations, dysmenorrhœa. Now little used, owing to its dangerous depressing and uncertain action, as aconitine can well be substituted for it.

**Poisoning, Incompatibles, Synergists:** Same as for aconite.

**10. LILIACEÆ. Lily Family.**

Lil-i-a'se-e. *L. Lili-um* + *aceæ*, a lily, fr. Celtic *li*, whiteness, alluding to beautiful white flowers of original species. Herbs, shrubs, or trees. Distinguished by having bulbs, rhizomes, tubers, or fibrous roots; leaves parallel-veined; flowers regular symmetrical, 6-androus, perianth non-glumaceous, petaloid, free from 3-celled, superior ovary; anthers 2-celled; fruit many- or few-seeded pod or berry; temperate climates, tropics; purgative, emetic, diuretic, diaphoretic, stimulant, astringent, acid; fibres, food, condiment.

Genera: 1. **Urginea.** 2. **Aloe.**

**SCILLA. SQUILL.**

**Urginea**  
**maritima,** } The bulb deprived of its dry, membranaceous outer  
(*Linné*) *Baker.* } scales, cut into thin slices and carefully dried, the  
central portions being rejected.

**Habitat.** Mediterranean Basin, near the sea; Spain, France, Italy, Greece, Portugal, Morocco, Algeria; in sandy, also hilly localities.

**Syn.** Sea Onion, White or Red Squills; Fr. Squille, Scille; Ger. Bulbus Scillæ, Meerzwiebel.

**Ur-gin'e-a.** *L. urgere*, to press, urge—*i. e.*, its flattened, compressed seeds; or fr. Algerian Arab tribe *Ben urgin*.

**Ma-rit'i-ma.** *L. maritimus*, of the sea, maritime—*i. e.*, its habitat near the sea.

**Scil'la.** *L.* fr. Gr. *σχιλλω*, to split—*i. e.*, splits into scales; *σχιλλα*, an onion.

**PLANT.**—Perennial herb; roots fibrous from base of large bulb; leaves appear long after flowers, several, .5–.6 M. ( $1\frac{1}{2}$ –2°) long, shining, deep green; flowers white, on succulent stem, .3–1 M. (1–3°)

high, in close spike, no calyx, peduncles purplish; fruit, dry capsule 12 Mm. ( $\frac{1}{2}$ ') long, oblong, 3-lobed, yellow, seeds 6 in each cell, 6 Mm. ( $\frac{1}{4}$ ') long, flattened, purplish-brown. BULB, pear-shaped when

FIG. 40.

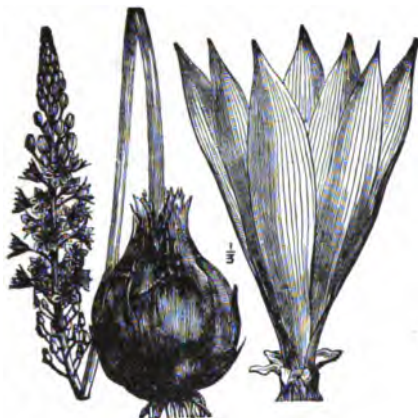
*Urginea maritima.*

FIG. 41.



Scilla bulb, prepared for slicing.

fresh, size of fist to child's head, 7.5–15 Cm. (3–6') long and broad, often weighing 4 pounds (1.8 Kg.). Consists of fleshy scales, with attenuated edges closely applied over one another; in shops as narrow irregular, more or less curved segments, 3–5 Cm. ( $1\frac{1}{3}$ –2') long, somewhat translucent, yellowish-white or reddish-white, brittle and pulverizable when dry, tough and flexible when damp; odor slight; taste mucilaginous, bitter, acrid. *Solvents*: alcohol (75 p. c.); diluted acetic acid; vinegar, water. Dose, gr. 1–5 (.06–.3 Gm.) ter die until nauseated; gr. 5–10 (.3–.6 Gm.) will usually cause vomiting.

*Commercial*.—Bulb flourishes in dry, sandy places on seacoast, being one half immersed in the soil; flowers in autumn, but leaves appear in following spring. Early was known as a valuable medicine, but first cultivated in Europe 1630. There are 2 varieties—*white* and *red*, the former having white scales, the latter reddish-brown and rose color; both are the same medicinally, yet the white is preferred, as it makes less colored solutions. Bulbs are collected in August, deprived of dry outer scales and central portions (the latter being of youngest growth and therefore deficient in activity), cut transversely into thin slices, dried by sun, packed in casks, and shipped from Malta; the mucilaginous and hygroscopic tendency requires great care in drying, neglect in this often giving inferior product; the bulb abounds in viscid, acrid juice, which excoriates the skin when handled, but this quality is lost upon drying without changing medicinal properties; loses 80 p. c. on drying, reabsorbs 11 p. c. moisture on exposure, becoming mouldy, hence should be kept dry in well-stoppered bottles.

## LILIACEÆ.

CONSTITUENTS.—Scillitin (scillipicrin, scillitoxin, scillin), Sinistrin, sugar, 22 p. c., volatile oil, calcium oxalate 3–8 p. c., ash 3 p. c.

Scillitin.—Bitter principle, upon which activity depends, but it has never been obtained pure. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.01–.03 Gm.). Instead of this, Merck gives 3 active principles:

(1) Scillipicrin.—Bitter principle, yellowish-white, amorphous, soluble in water, hygroscopic; acts upon the kidneys. Dose, gr.  $\frac{1}{8}$ –1 (.02–.06 Gm.).

(2) Scillitoxin (Scillain).—Glucoside, brown, bitter, burning taste, amorphous, insoluble in water, ether, soluble in alcohol; acts upon heart. Dose, gr.  $\frac{1}{80}$ – $\frac{1}{36}$  (.001–.002 Gm.).

(3) Scillin.—Crystalline, pale yellow, soluble in alcohol, hot ether; benumbs, induces vomiting. S. Wanizewski has suggested the following names for the active principles: (1) Scillapicrine, soluble in water, alcohol; (2) Scillamarine, soluble in chloroform, alcohol; (3) Scillinine, soluble in alcohol, insoluble in water, chloroform.

Sinistrin,  $C_6H_{10}O_5$ .—White mucilage, resembles dextrin, levogyrate, easily converted into sugar by boiling with diluted sulphuric acid.

PREPARATIONS.—1. *Acetum Scillæ*. Vinegar of Squill: (Syn., Fr. Vinaigre (Acétolé) scillitique; Ger. Meerzwiebeleessig.)

*Manufacture*: 10 p. c. Macerate 10 Gm. with diluted acetic acid q. s. 100 Cc., heat to boiling, filter. Dose,  $\mathfrak{M}$ v–30 (.3–2 Cc.).

Prep.: 1. *Syrupus Scillæ*. Syrup of Squill. (Syn., Syrupus Aceti Scillæ; Fr. Sirop de Scille; Ger. Meerzwiebelsirup.)

*Manufacture*: Vinegar of squill 45 Cc., sugar 80 Gm., water q. s. 100 Cc. Dose, 3ss–1 (2–4 Cc.).

2. *Fluidextractum Scillæ*. Fluidextract of Squill. (Syn., Extractum Scillæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Scille; Ger. Flüssiges Meerzwiebelextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with acetic acid 27.5 Cc. + water 72.5, finishing with same menstruum q. s. 100 Cc. Dose,  $\mathfrak{m}$ j–5 (.06–.3 Cc.).

Prep.: 1. *Syrupus Scillæ Compositus*. Compound Syrup of Squill. (Syn., Hive Syrup, Croup Syrup; Fr. Sirop de Scille composé; Ger. Zusammengesetzter Meerzwiebelsirup.)

*Manufacture*: Fluidextract of squill 8 Cc., fluidextract of senega 8, antimony and potassium tartrate .2 Gm., purified talc 2, sugar 75, water q. s. 100 Cc. Dose,  $\mathfrak{M}$ v–60 (.3–4 Cc.).

Cox's Hive Syrup differs from this preparation only in the use of honey instead of sugar as the preservative.

3. *Tinctura Scillæ*. Tincture of Squill. (Syn., Fr. Teinture de Scille; Ger. Meerzwiebeltinktur.)

*Manufacture*: 15 p. c. Macerate, percolate 15 Gm. with alcohol 75 p. c., q. s. 100 Cc. Dose,  $\mathfrak{M}$ v–30 (.3–2 Cc.).

*Unoff. Preps.*: *Acetic Extract*, dose, gr.  $\frac{1}{8}$ –2 (.01–.13 Gm.). *Oxymel Scillæ* (Br.), 7 p. c. *Pilula Scillæ Composita* (Br.).

PROPERTIES.—Resembles digitalis; expectorant, diuretic, emetic, cardiac stimulant, cathartic, irritant. Large doses irritant poison,

causing gastro-enteritis, strangury, bloody urine, convulsions, death by heart paralysis.

**Uses.**—Expectorant in croup, irritant coughs, whooping-cough, bronchitis, asthma, associated with ipecac, ammonia, asafetida, benzoin, etc. Owing to its irritating properties should not be given in acute stage. Diuretic in dropsies from cardiac disease, when it should be combined with digitalis or saline diuretics. Give to children with croup until nausea and vomiting occur. The Greeks, Romans, and Arabians used it in dropsies, ulcerated gums and throat, weak digestion.

Fresh juice applied to abrasions is diuretic; to healthy skin rubefacient, which may be due to calcium oxalate needle-shaped crystals or to contained acrid resinoid, here also ultimately get the diuretic effect.

**Poisoning:** Similar to digitalis. Evacuate stomach, give tannin, demulcents, opiates, stimulants, etc.

**Allied Plants:**

1. *Allium sativum*, *Garlic*.—The bulb used without drying, official 1820–1900. C. Asia, S. Europe. Bulbous plant, .6 M. (2°) high; leaves long, flat, grass-like; flowers small, white, umbels. Bulb, subglobular, compounded of 8-wedged bulblets, covered by several membranous scales; odor pungent, alliaceous; taste warm, acrid; contains volatile oil 0.25 p. c., mucilage 35 p. c., albumin, sugar, starch, water 60 p. c. Stimulant, carminative, condiment, diuretic, expectorant,



rubefacient; bronchitis, indigestion, infantile catarrh; poultice in catarrhal pneumonia, abscesses, earache, convulsions of children, insect and serpent wounds. Dose, ʒss–1 (2–4 Gm.); syrup, 20 p. c., ʒj–4 (4–15 Cc.); volatile oil, m̄j–5 (.06–.3 Cc.).

2. *A. Cepa*, *Onion*, and *A. Por'rum*, *Leek*: both used like garlic.

## ALOE. ALOES.

**Aloe** { *vera*, (Linné) Webb, .  
          *chinensis*, Baker,  
          *Perryi*, Baker, and other species. } The inspissated juice of the leaves.

**Habitat.** 1. N. W. Africa, India; naturalized in Barbadoes Islands, Dutch W. Indies; cultivated in Italy, Sicily, Malta. 2. W. India; cultivated in Curaçao, Aruba, Bonaire. 3. E. Africa, Island of Socotra; cultivated.

**Syn.** Aloe Barbadensis, Aloe Socotrina, U. S. P. 1890. 1. and 2. Aloe Barbadensis, Barbadoes-, Curaçao-, East Indian-, India-, Bitter-, Hepatic-, or Horse Aloes; Fr. Aloès hépatique des Barbades, ou de la Jamaïque; Ger. Barbadoes Aloe. 3. Aloe Socotrina, Socotrine (*sucus citrinus*); Bombay-, Mocha-, Turkey-, or Zanzibar-Aloes; Fr. Aloès (Socotrin) Sucotrin; Ger. Aloë, Aloe, Socotra Aloe, Socotrinische Aloe.

**Al'o-e.** L. fr. Ar. *Alloeh*, Gr. *ἀλόη*, native names for the aloe.

**Ve'ra.** L. *vera*, true—i. e., the original and true primitive kind.

**Chi-nen'sis.** L. (*sinensis*) Chinese, of or belonging to China—i. e., its original habitat.

**Per'ry-i.** L. after Wykeham Perry, who studied the plant natively.

## LILIACEÆ.

PLANTS.—All species of aloes resemble to some extent *Aga've americana*, American Aloe or century plant; stems 1.5 M. (5°) high, woody, very rough from remnants of previous leaves; leaves glaucous-green, sometimes mottled with darker spots, thick, succulent, bayonet-shaped,

FIG. 43.

*Aloe vera (vulgaris).*

FIG. 44.

*Aloe Perryi.*

with reddish spines or white serratures on the margin; flowers racemose or spicate, tubular, yellowish or orange-red, stamens 6, unequal, 3 longer than corolla. **INSPISSATED JUICE** (aloes), in yellowish-brown to blackish-brown opaque masses, fracture uneven, dull, waxy, somewhat resinous, or smooth and glassy, somewhat conchoidal, occasionally exhibiting microscopic crystals of aloin; odor characteristic; taste nauseous, bitter. *Tests*: 1. With nitric acid or solutions of the alkalies get reddish color; when dried should not lose more than 10 p. c.; 5 Gm. + boiling water 60 Cc. should give clear solution, which upon cooling separates not more than 2 Gm. 2. Heat gently 1 Gm. + 5 Cc. alcohol, upon cooling solution should be nearly clear (abs. gum, dextrin, inorganic impurities). *Solvents*: alcohol, boiling water, or 4 parts cold water; not affected by chloroform or ether. Dose, gr.  $\frac{1}{2}$ –10 (.03–.6 Gm.).

**ADULTERATIONS.**—**ALOES**: Chiefly dried juice of inferior allied species, also small quantities of leaves, wood, sticks, stones, leather, monkey and goat skins, implements (knives, etc.), iron, resin, pitch, ochre, burned bones, gum, licorice, etc.; 5–27 p. c. **ALOIN**: Resinous and other matter, recognized by imperfect solubility in water.

*Commercial.*—Aloe was known to Dioscorides and Celsus. The



large, thick leaves contain in their centre an insipid, thick, mucilaginous juice, and near the surface in distinct, elongated, thin-walled ducts a bitter yellowish juice (aloetic), which varies in activity with age of leaf and season of year. This superficial juice, possibly serving for plant protection, is collected when not too scanty or watery, March–April, just after the rainy season, by cutting off the leaves near their base, during sunshine, and standing them up for half an hour in skins, or a series of 5 V-shaped wooden troughs (1.2 M.; 4° long—.3–.5 M.; 12–18' deep), each with an opening in the lower inclined end, to run off juice, as it exudes by gravity alone (any pressure serving to expel also the undesirable central juice, possessing emmenagogue properties and adapted for poultices) into metal, iron or copper, vessels for evaporation; this latter being continued 5 hours with ladling out of impurities. The juice, at first colorless, soon becomes yellowish-brown on exposure, and sometimes is kept in barrels for months, as it does not spoil, and then according to demand is reduced slowly by sun (socotrine) or rapidly by fire (barbadoes); moderate artificial heat does not injure medicinal properties, but imparts a heavier odor. In Curaçao immediate evaporation, below the boiling-point, yields a variety called "Capey," from its lustre and yielding a yellowish powder, but when kept a year before evaporation the surface is dull, odor suggestive of fermentation, powder brownish, and the water-soluble matter 4–13 p. c. When of proper consistence the evaporated product—commercial aloes—is poured into gourds (2–15–50 pounds; 1–7–23 Kg.), or boxes (60–100 pounds; 27–46 Kg.), as in the W. Indies—being shipped chiefly from Curaçao, some from Bonaire, Jamaica and Barbadoes, or casks, kegs, cans, tin-lined boxes, monkey or goat skins, etc.,—being shipped via Bombay and Zanzibar, as in the socotrine variety. Although there are a number of commercial varieties, only two have an accepted recognition in medicine: 1. *Barbadoes*, *Curaçao* [*A. vera* (*vulgaris*), *A. chinensis*]. This constitutes most of the aloes used; it is rather hard, brittle, orange-brown to deep brown, conchoidal, waxy lustre, or resinous and barely glossy (Capey), odor when breathed upon aromatic, resembling saffron or myrrh, 30 p. c. soluble in cold water, 10 p. c. in ether, acquiring yellow color. This commands a higher price upon keeping, by which it is claimed to improve; it is produced mainly in Curaçao, Aruba, and Bonaire, while Barbadoes furnishes very little if any, but under this name the others are sold frequently at a much higher price. 2. *Socotrine* (*A. Perryi* +). This is the most expensive and highly esteemed aloes; it is usually solid with centre soft, yellowish-brown, little or no lustre; harder portions lightly conchoidal, odor when breathed upon finely aromatic, saffron-like, more agreeable than barbadoes; powder bright yellow, soluble in alcohol, boiling water, from the latter solution upon cooling 40–60 p. c. separates (resin of aloes), which is taken up by alkalies and reprecipitated by acids, 4–5.5 p. c. soluble in ether, 50 p. c. in cold water.

CONSTITUENTS.—Aloin (soc-aloin), Resin 30–50 p. c., Emodin .8 p. c., volatile oil 0.0015 p. c., ash 1–4 p. c.

**LILIACEÆ.**

**Aloinum.** Aloin, *official*.—Neutral principle chiefly from Curaçao aloes, Socotrine aloes (soc-aloin,  $C_{15}H_{16}O_7$ ), and Barbadoes aloes (barb-aloin,  $C_{17}H_{20}O_7$ ); sparingly from Natal aloes (nat-aloin,  $C_{16}H_{18}O_7$ ), and other species, each product slightly differing. It is obtained by digesting Socotrine or Jafferabad aloes 1 part, in alcohol 3 parts, for 24 hours, boiling 2 hours, filtering, setting aside for crystallization—yield 10 p. c.; or by dissolving Barbadoes, Curaçao, or Bonaire aloes 1 part in boiling acidulated ( $HCl$  or  $H_2SO_4$ ) water 10 parts, after letting stand a day, for resin to deposit, decant, evaporate to 2 parts, set aside 2 weeks to crystallize—yield 20–25 p. c. It is a yellowish, micro-crystalline powder, slight odor of aloes, intensely bitter taste, slightly hygroscopic, soluble in 65 parts water, 10.75 alcohol, 664 ether, 4,260 chloroform, 21 acetone, melts at  $147^\circ C.$  ( $297^\circ F.$ ), no residue. *Tests*: 1. Nitric acid dissolves curaçao-aloin, forming cherry-red solution (dis. from nat-aloin, soc-aloin, cap-aloin). 2. Hydrochloric acid added to alcoholic solution yields aloë-emodin.

Barb-aloin + nitric acid gives crimson color; is oxidized into one-third its weight (33 p. c.) of chrysammic acid (in golden-yellow laminae) and smaller quantities of aloetic (orange-red powder), picric, and oxalic acids; identical with this are curaçao-aloin, ugand-aloin, and cap-aloin.

Soc-aloin + nitric acid gives no color-change, otherwise same as barb-aloin.

Nat-aloin, little purgative to man, least soluble in nitric acid, but gives crimson color, and oxidizes into only picric and oxalic acids; if add sulphuric acid get blue color, which is not the case with two preceding. Aloin is twice as active as aloes and produces usually no griping. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

**Resin.**—Obtained by allowing a dilute aloetic infusion to cool, when it precipitates, filter, dry. Soluble in hot water (thus differing from other resins), alcohol, ether, alkaline solutions; brownish-black by ferric salts; by hydrolysis yields cinnamic acid and aloesino-tannol; equally active as the drug, which may be from accidental aloin present.

**Emodin (Aloë-emodin).**—Obtained by dissolving it from aloin by ether; it is the purgative principle of aloin and consequently of aloes. In aloin, just as in anthraglucosennin, rheïn, frangulin, and purshianin, the alkaline secretions of the upper intestine must produce decomposition, whereby the emodin thus set free may produce peristalsis, hence the cathartic action of the drug.

**PREPARATIONS.**—I. **ALOES**: 1. *Extractum Aloes*. Extract of Aloes. (Syn., *Extractum Aloes Socotrinæ*; Br. *Extractum Aloes Barbadosensis*; Fr. *Extrait d'Aloès*; Ger. *Aloëextrakt*.)

*Manufacture*: Mix aloes 10 Gm. with boiling water 100 Cc., stir, let stand 12 hours, pour off clear liquid, strain residue, evaporate mixed liquids to dryness. Dose, gr.  $\frac{1}{2}$ –5 (.03–.3 Gm.).

2. *Aloë Purificata*. Purified Aloes. (Syn., Fr. *Aloès dépuré*; Ger. *Gereinigte Aloë*.)

**Manufacture:** Socotrine aloes 100 Gm., melt, add alcohol 20 Cc., evaporate strained solution. Alcohol insures fluidity sufficiently long for it to pass through a No. 60 sieve. Occurs in irregular brittle pieces, brownish-red, peculiar odor of aloes, almost entirely soluble in alcohol. Should be kept in well-stoppered bottles. This process removes most of the impurities mentioned under adulterations. Dose, gr.  $\frac{1}{2}$ –10 (.03–.6 Gm.).

**Preps.:** 1. *Pilulæ Aloes.* Pills of Aloes. (Syn., Br. *Pilula Aloes Socotrinæ*; Fr. *Pilules d'Aloès et de Savon*; Ger. *Aloepillen*.)

**Manufacture:** Purified aloes 13 Gm., soap 13, water q. s. 100 pills. Dose, 1–4 pills.

2. *Pilulæ Aloes et Ferri.* Pills of Aloes and Iron. (Syn., Fr. *Pilules d'Aloès et de Fer*; Ger. *Pilulæ aloëticæ ferratæ*, *Eisenhaltige Aloepillen*, *Pilulæ Italicæ Nigræ*, *Aloe und Eisenpillen*, *Italienische Pillen*.)

**Manufacture:** Purified aloes, exsiccated ferrous sulphate, aromatic powder, each 7 Gm., confection of rose q. s. 100 pills. Dose, 1–4 pills.

3. *Pilulæ Aloes et Mastiches.* Pills of Aloes and Mastic. (Syn., *Lady Webster's Dinner Pills*; Fr. *Pilules d'Aloès et de Mastix*; Ger. *Aloe- und Mastix-Pillen*.)

**Manufacture:** Purified aloes 13 Gm., mastic 4, red rose 3, diluted alcohol q. s. 100 pills. Dose, 1–4 pills.

4. *Pilulæ Aloes et Myrrhæ.* Pills of Aloes and Myrrh. (Syn., *Rufus's Pills*; Fr. *Pilules d'Aloès et de Myrrhe*, *Pilules de Rufus*; Ger. *Rufussche Pillen*.)

**Manufacture:** Purified aloes 13 Gm., myrrh 6, aromatic powder 4, syrup q. s. 100 pills. Dose, 1–6 pills.

5. *Tinctura Aloes.* Tincture of Aloes. (Syn., Fr. *Teinture d'Aloès*; Ger. *Aloetinktur*.)

**Manufacture:** 10 p. c. Macerate 7 days, with occasional agitation, purified aloes 10 Gm., glycyrrhiza 20, with diluted alcohol q. s. 100 Cc. Dose, 3ss–2 (2–8 Cc.).

6. *Tinctura Aloes et Myrrhæ.* Tincture of Aloes and Myrrh. (Syn., Fr. *Elixir de Propriété*; Ger. *Tinctura Aloes composita*, *Zusammengesetzte Aloetinktur*, *Elixir Proprietatis Paracelsi*, *Aloeelixir*.)

**Manufacture:** Macerate 7 days, with occasional agitation, purified aloes, myrrh, glycyrrhiza, each 10 Gm. with alcohol 75 p. c., q. s. 100 Cc. Dose, 3ss–2 (2–8 Cc.).

7. *Extractum Colocyntidis Compositum*, 50 p. c. 8. *Pilulæ Rhei Compositæ*, 1½ gr. (.1 Gm.). 9. *Tinctura Benzoini Composita*, 2 p. c.

II. ALOIN: 1. *Pilulæ Laxativæ Compositæ.* Compound Laxative Pills. (Syn., *Pilulæ Aloini*, *Belladonnæ*, et *Strychninæ Compositæ*; Fr. *Pilules Laxatives composées*; Ger. *Zusammengesetzte Laxirpillen*.)

## LILIACEÆ.

*Manufacture:* Triturate together aloin 1.3 Gm., strychnine .05, ipecac .4, glycyrrhiza 4.6, incorporate with this extract of belladonna leaves .8, syrup q. s. 100 pills. Dose, 1–3 pills.

*Unoff. Preps.:* *Pulvis Aloes et Canellæ*, *Hiera Picra*—Aloes 80 + canella 20, dose, gr. 15–30 (1–2 Gm.). *Decoctum Aloes Compositum* (Br.), 1 p. c. *Wine (Vinum)*.

**PROPERTIES.**—Cathartic, drastic, emmenagogue, vermifuge, stomachic. The action is especially on the colon and lower half of the large intestine, and thus causes irritation to uterus and inflamed hemorrhoids; stimulates the functions of the liver, intestinal secretions generally, increases the flow of bile, and acts in about 15 hours. Abnormal doses do not produce proportionately excessive results, but invariably cause tormina, tenesmus with heat, and rectal irritation. The irritation to stomach and rectum is largely remedied by combining with soap or an alkaline carbonate.

**USES.**—Costiveness (dependent upon weakness of muscular layer of the large intestine), atonic dyspepsia, jaundice, non-active hemorrhoids, amenorrhœa, ascariæ; for the two last may give by enema.

*Poisoning:* Have irritation of intestinal canal, causing pain, vomiting, and purging, cold sweats, prostration, sometimes convulsions, collapse. Empty stomach, give demulcents, opium, stimulants, artificial heat to body and extremities, hot fomentations to abdomen.

*Allied Products:*

1. *Cape Aloes, Shining Aloes (Aloe spica'ta (capen'sis), Spiked Aloes)*.—Flowers in spikes, official 1850–1880. This is also possibly from *A. ferox*, *A. africa'na*, *A. plicat'ilis*, etc. Cape of Good Hope. Has fracture shining, conchoidal, dark olive color; imported in casks and boxes.

2. *Hepatic Aloes*.—This name was applied formerly to a variety of Socotrine aloes from E. Indies, but now the term is given in this country to Barbadoes, in fact to any opaque liver-colored aloes.

3. *Natal Aloes*.—This has a greenish-slate hue, crystalline, fracture less shining than, but odor of Cape aloes; it is of little value, and is shipped from Port Natal.

4. *Moka Aloes*.—This has brownish-black color, irregular fracture, disagreeable odor, and is from the interior of Arabia.

5. *Cuballine or Horse Aloes*.—This is inferior, impure, having a dark color, fetid odor, being from irregular sources.

6. *Jafferabad Aloes*.—This has black-pitch color and lustre, glassy, porous fracture, and is less agreeable than Socotrine aloes.

*Allied Plant:*

1. *Erythro'nium america'num, Yellow Adder's-tongue*.—The root and herb, official 1820–1850.—United States. Perennial herb, scape 15–22.5 Cm. (6–9') high, slender, leaves 2, pale green, equal length 12.5 Cm. (5'), one twice as wide as the other, brown-spotted, flowers yellow, 2.5–5 Cm. (1–2') long, root (bulb or corm) solid, brown; inside white. All parts of the plant active; used like colchicum. Dose, gr. 20–30 (1.3–2 Gm.) in infusion. Large doses emetic.

## RECAPITULATION No. 1.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Gigartinales:</i> 1. Chondrus. 2. Chondrus.	<i>Chondrus crispus</i> .	The dried plant.	Atlantic Ocean.	Mucilage, albuminoids, minerals.	.....	Demulcent, nutritive, dietetic.	Bronchitis, diarrhoea, kidney and bladder trouble, scrofula.	Grains. 60-120 (4-8 Gm.).
<i>Hypocneceae:</i> 1. Ergota. 2. Ergot.	<i>Claviceps purpurea</i> .	The sclerotium.	Russia, Spain.	Fixed oil, cornutine, ergotine, sclerotic acid, mycose, proteids, cholesterolin.	Fluidextr., extr. wine.	Emmenagogue, ecboic, hemostatic, excitomotor, poisonous.	In labor, dysmenorrhoea, polypt, amenorrhoea, hemorrhages, hemorrhoids.	15-60 (1-4 Gm.).
<i>Polypodiaceae:</i> 1. Aspidium. 2. Aspidium.	<i>Dryopteris Filix-mas</i> , marginalis.	The dried rhizome.	N. America, N. Asia, Europe.	Fillic acid, fillicin, fixed oil, filitanic acid, vol. oil, resin.	Oleoresin.	Tanifuge.	Tape-worms.	30-120 (2-8 Gm.).
<i>Lycopodiaceae:</i> 1. Lycopodium. 2. Lycopodium.	<i>Lycopodium clavatum</i> +.	The spores.	Europe, Asia, N. America.	Fixed oil, cane-sugar, volatile base (methylaniline).	.....	Diuretic, antispasmodic for rheumatism, epilepsy, pulmonary, renal disorders.	Externally for erysipelas, eczema, herpes, ulcers, chafing, to prevent adhesion of pills and suppositories.	15-60 (1-4 Gm.).
<i>Pinaceae (Coniferae):</i> 1. Terebinthina. 2. Turpentine.	<i>Pinus palustris</i> +.	The concrete oleoresin.	S. United States.	Volatile oil, resin, bitter principle, formic, succinic, and other acids.	<i>Oil:</i> Kecti. oil, liniment, terebene, terpin hydrate, emul., canthar. cerate. <i>Rosin:</i> ros. cer., ros. cer. co., cer. canth., tar. Flexible collodion.	Stimulant, carminative, cathartic, antihelminthic, hemostatic, expectorant, antiseptic, diuretic, rubefacient.	Bronchitis, catarrh, cystitis, gleet, urinary troubles, piles, hemorrhages, erysipelas, worms, pneumonia, rheumatism, renal colic, sprains, scabies.	15-60 (1-4 Gm.).
1. Terebinthina Canadensis. 2. Canada Turpentine.	<i>Abies balsamea</i> .	The oleoresin.	N. America.	Volatile oil, resin, bitter principle.	.....	Stimulant, counter-irritant, support.	Bronchitis, catarrh, cystitis, gleet, urinary troubles, piles, hemorrhages, erysipelas, worms, pneumonia, rheumatism, renal colic, sprains, scabies.	15-60 (1-4 Gm.).
1. Oleum Juniperi. 2. Oil of Juniper.	<i>Juniperus communis</i> .	Volatile oil.	N. America.	Pinene, $C_{10}H_{16}$ , cadinene, $C_{15}H_{24}$ .	Spirit, comp. spt.	Stimulant, diuretic, anodyne.	Renal dropsy, urinary catarrh, rheumatism, swellings.	Minims. 5-15 (3-1 Cc.).
1. Oleum Cadinum. 2. Oil of Cade.	<i>Juniperus Oxycedrus</i> .	Volatile oil.	S. Europe.	Phenols, cadinene, $C_{15}H_{24}$ .	.....	Antiseptic, emmenagogue, curminative.	Poriasis, pityriasis rubra, eczema.	3-5 (2-3 Cc.).
1. Sabina. 2. Savin.	<i>Juniperus Sabina</i> .	The tops.	Siberia, Europe.	Volatile oil, resin, tannin.	Fluid-extract, oil.	Diuretic, emmenagogue, irritant, vermifuge.	Amenorrhoea, menorrhagia, sterility, chlorosis, rheumatism, gout, warts, ulcers, polypt.	(Grains. 5-15 (3-1 Gm.).

<b>Gramineae:</b> 1. Zea. 2. Zea.	<b>Zea Mays.</b> .....	The fresh styles and stigmas.	S. America.	Malzevic acid, fixed oil, resin, sugar, mucilage, salts.  (C <sub>4</sub> H <sub>10</sub> O <sub>6</sub> ) <sub>2</sub>	Glycerite.	Diuretic, lithon- triptic, demul- cent, anodyne, attractive. Nutritive, demul- cent.	Cystitis, uric acid and phosphates, gravel, gonorrhea, dropsy, from heart, Alays itching, urti- caria, erysipelas, in- flamed rectum, blad- der, protective.	30-120 (2-8 Gm.).  34-120 (2-8 Gm.).
<b>α</b> 1. Amylum. 2. Starch.	<b>Saccharum officinarum</b> , also species of <i>Sorghum</i> and <i>Beta</i> .  <b>Agropyron repens</b> .	The starch grains from fruit.  The juice evaporated and crys- tallized.	S. Asia.	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> .	Syrup, many troches and med- icated syrups, pills, powders, etc. Fluidextract. Extract.	Demulcent, leni- tive, laxative, ulcerations.  Diuretic, aperient, demulcent.	Vehicle, corrigent, pre- servative, antiseptic, excellent, coughs, hic- cough, ascarides, ul- cers, sores, eye troubles.	Ad libi- tum.
1. Triticum. 2. Triticum.	<b>Hordeum disti- chon</b> .	The dried rhizome.  The partially germinated grain dried.	Europe. N. America.	Triticin, fruit-sugar, inositol, glucose, mal- ates, lactic acid. Diastase, peptose, dextrose, sugar, starch.	.....	Nutritive, laxa- tive, demulcent.	Cystitis, gravel, jaun- dice, bronchitis, gout, skin troubles, fevers.	30-180 (2-12 Gm.).
<b>Palmae:</b> 1. Sabal. 2. Sabal.	<b>Serenoa serrulata</b> .	The partially dried ripe fruit.	S. United States.	Volatile oil, fixed oil, fat, alkaloid, resin.	.....	Sedative, diuretic, expectorant, tonic.	Dyspepsia, phthisis, whooping-cough, pros- tate gland, asthma.	Ad libi- tum.
<b>Araceae:</b> 1. Calamus. 2. Calamus.	<b>Acorus Calamus</b> .	The unpeeled dried rhi- zome.	N. America.	Volatile oil, acorin (calamine), starch, resin.	Fluidextract.	Stimulant, carmin- ative, tonic, bitter, aromatic.	Dyspepsia, colic, typhi- d. coughs, flatulency, flavoring, insectifuge.	15-60 (1-4 Gm.).
<b>Melanthaceae:</b> 1. Veratrum. 2. Veratrum.	<b>Veratrum viride</b> , album.	The dried rhizome and roots.	N. America.	Protoveratrine, jer- vine, rubijervine, reva- pseudojervine, reva- dine, resin—veratroi- dine, veratralbine.	Fluidextract, tincture.	Sedative, emetic, diaphoretic, errhine.	Arterial excitement, spinal spasms, pneu- monia, typhoid, heart troubles, convulsions, tetanus, chorea, mania.	1-4 (0.05-25 Gm.).
1. Veratrina. 2. Veratrine.	<b>Asagrea officinalis</b> .	A mixture of alkaloids.	Mexico, S. America.	Veratrine, cevadine, veratridine, cevadil- line, sabadine, saba- doline.	Oleate, ointment.	Powerful irritant, sternutatory, errhine.	Neuralgia, headache, sciatica, pediculi, rheu- matism, pneumonia, sprains, heart trouble.	3-12 (0.02-0.05 Gm.).
<b>Liliaceae:</b> 1. Scilla. 2. Squill.	<b>Urginea maritima</b> .	The bulb.	Mediterran- ean Basin.	Scyllitin, sinistrin, sugar, Ca oxalate.	Vinegar, syrup, fluidextr., comp. syrup, tincture.	Expectorant, cardiac stimulant, diuretic, emetic, cathartic, irritant.	Croup, coughs, bron- chitis, asthma, drop- sies, whooping-cough, Cystitis.	1-5-10 (0.05-3-6 Gm.).
1. Aloe. 2. Aloes.	<b>Aloe vera</b> , chi- nensis, Perryi.	The inspis- sated juice.	E. Africa, Socotra, W. Indies, Curaçao.	Aloin, resin, emodin, volatile oil.	Extr., <i>Purif. Aloes</i> : pills, p. a. et. fer., p. a. et. mast., p. a. et. myr., tinct., tr. a. et. myr., extr. coloc. co., pli. rhel. co., tr. benz. co., atan : p. lax. co.	(athartic, drastic, emmenagogue, vermifuge.	Cystitis, jaundice, hemorrhoids, amenor- rhea, ascarides.	1/2-10 (0.02-6 Gm.).

## 11. CONVALLARIACEÆ. Lily-of-the-Valley Family:

Kon-va-la-ri-a'se-e. L. *Convallaria* + aceæ, fr. L. *con*, together, + *vallis*, valley—a valley enclosed on all sides—*i. e.*, alluding to the preferred place of growth of some species. Leafy-stemmed, erect herbs. Distinguished by having branched rootstocks, never bulbs or corms; leaves broad, parallel-veined, perianth 6-lobed or toothed, stamens 6, ovary 2-3-celled, superior; fruit fleshy berry, stigma 3-lobed; temperate climates; purgative, emetic, diuretic, diaphoretic, alterative, poisonous.

Genera: 1. *Convallaria*. 2. *Colchicum*.

## CONVALLARIA. CONVALLARIA.

**Convallaria** } The dried rhizome and roots.  
**majalis**, Linné. }

*Habitat.* United States (Allegheny Mountains, Virginia, South Carolina), Europe, Asia; cultivated in gardens.

*Syn.* Lily of the Valley, *Lilium Convallium*, May-, Park-, or Wood-Lily, *Conval-lily*, May-blossom; Fr. Muguet; Ger. Maiblumen.

**Con-val-la-ri-a.** See etymology, above, of Convallariaceæ.

**Ma-ja'lis.** L. gelded, emasculated—*i. e.*, its stem.

**PLANT.**—Stemless perennial; leaves 2-3, radical; smooth, elliptical; flowers May, 1-sided raceme of about 10 blooms, each bell-shaped, white, 6-lobed, 6 Mm. ( $\frac{1}{4}$ ') long, cultivated larger, sweet-scented, bitter taste, nodding on an angled scape; fruit red berries. **RHIZOME**, of horizontal growth, somewhat branched, length variable, 1-3 Mm. ( $\frac{1}{25}$ - $\frac{1}{3}$ ') thick, internodes about 5 Cm. (2') long, cylindrical, pale brown, marked with few circular stem-scars and at each joint with a circle of root-scars or thin, tortuous and branched roots, fracture fibrous, weak, internally whitish; odor distinct; taste sweetish, bitter, acrid. *Solvents*: diluted alcohol; boiling water partially. Dose, gr. 2-10 (.13-.6 Gm.).

*Commercial.*—Our plant is identical with that grown in European gardens. Rhizome should be collected July-Aug., washed and carefully dried in the sun, thereby losing 85 p. c.

**CONSTITUENTS.**—Convallamarin 0.6 p. c., Convallarin, resin.

**Convallamarin**,  $C_{23}H_{44}O_{12}$ .—Bitter glucoside (cardiac constituent), obtained by precipitating alcoholic tincture with basic lead acetate; filter, evaporate, dilute with water, neutralize with sodium carbonate, precipitate with tannin, dissolve this in alcohol (60 p. c.), decolorize with charcoal, decompose with zinc oxide, filter, evaporate; yield 0.6 p. c. It is a white powder, bitter, sweet, soluble in alcohol, water, insoluble in ether, chloroform; with diluted acids converted into sugar and convallamaretin. Dose, gr.  $\frac{1}{2}$ -2 (.03-.13 Gm.).

**Convallarin**,  $C_{34}H_{62}O_{11}$ .—Glucoside, acrid, purgative, in colorless prisms, soluble in alcohol, sparingly in water, foaming like saponin, insoluble in ether, boiled with diluted acids gives sugar and convallaretin. Dose, purgative, gr. 2-3 (.13-.2 Gm.).

## CONVALLARIACEÆ.

PREPARATIONS.—1. *Fluidextractum Convallariæ*. Fluidextract of Convallaria. (Syn., *Extractum Convallariæ Fluidum*, U. S. P. 1890, Fluidextract of Lily of the Valley; Fr. *Extrait liquide de Muguet*; Gr. *Flüssiges Maiblumenwurzelextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose,  $\text{Mij}$ –10 (.13–.6 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.). *Infusion*, 25 p. c., dose,  $\text{ʒss}$ –1 (15–30 Cc.).

FIG. 45.

*Convallaria majalis.*

PROPERTIES.—Heart tonic, emetic, purgative, diuretic, sternutatory, poisonous. Similar to digitalis, but free from cumulative action, hence thought a valuable substitute. Acts directly on the pneumogastric, finally arrests heart in systole.

USES.—Dropsy, heart disease, palpitation, disordered rhythm, weak heart, valvular affections, pneumonia, typhoid fever. Action lasts several days after use suspended. Once used for epilepsy and worms.

*Poisoning, Incompatibles, Synergists*: Same as for digitalis.

*Allied Plants*:

1. *Polygona'tum* (*Convalla'ria*) *multiflo'rum*, *European Solomon's Seal*, and *P. commuta'tum* (*gigante'um*), *American Solomon's Seal*.—Rhizome similar and contains convallarin, asparagin, mucilage, starch.
2. *Vag'nera* (*Smilaci'na*) *racemo'sa*, *False Solomon's Seal*.—N. America.



## COLCHICUM. COLCHICUM.

1. COLCHICI CORMUS. Colchicum Corm.

2. COLCHICI SEMEN. Colchicum Seed.

**Colchicum autumnale**, Linné.

- |   |   |
|---|---|
| } | 1. The dried corm, containing 0.35 p. c. of colchicine.         |
|   | 2. The (dried, ripe) seed, containing 0.55 p. c. of colchicine. |

*Habitat.* C. and S. Europe, N. Africa, (England, Greece, Turkey, Switzerland); moist pastures and meadows.

*Syn.* Meadow Saffron, Naked Ladies, Autumn-, Fog-, Meadow-, Michaelmas- or Purple- Crocus, Upstart, Bulbus (Tuber) Colchici; Colchici Radix, U. S. P. 1890, Colchici Semina; Fr. Colchique, Safran bâtard, Bulbe de Colchique—de Safran bâtard, Semences de Colchique; Ger. Semen Colchici, Zeitlosensamen, Herbstzeitlose, Wiesensafran, Zeitlosenknollen.

**Col'chi-cum.** L. fr. Gr. *κολχίς*, Colchis. An ancient province in Asia Minor, east of Black Sea, where this poisonous plant flourished; also the home of Media, the sorceress and poisoner of ancient legend.

**Au-tum-na'le.**—L. *au(r)umnalis*, belonging or peculiar to autumn—*i. e.*, the plant blooms Sept.-Oct., covering meadows with saffron-colored flowers resembling a carpet.

**PLANT.**—Bulbous perennial, several inches high; leaves radical, 3–5, sheathing 15–30 Cm. (6–12') long, 2.5–5 Cm. (1–2') wide, erect, entire, strap-shaped, smooth, shiny dark green; flowers 2–6, large,

FIG. 46.



*Colchicum autumnale*: 1, closed capsule; 2, open capsule; 3, styles; 4, cross-section of capsule; 5, seed.

lilac-purple, resembling crocus except anthers extrorse; corolla-tube 12.5–15 Cm. (5–6') long, two-thirds being underground; fruit of 3 inflated follicles, united at base, 4 Cm. (1½') long, brown, papery, dehiscent; seeds numerous. **CORM**, 25 Mm. (1') long, 18 Mm. (¾') thick, ovoid, convex on one side, flattish, with a groove on the other, externally brownish, wrinkled, internally whitish, solid; usually in transverse reniform slices 2 Mm. (⅛') thick, or longitudinal, ovate sections, having surfaces papillose from the numerous groups of fibrovascular bundles, fracture short, mealy; odor slight; taste sweetish, bitter, acrid; powder grayish, starch grains abundant. **SEED**, 2 Mm. (⅛') thick subglobular, slightly pointed at the hilum, reddish-brown, finely pitted, internally whitish, tough, and of almost bony hardness (by which they are distinguished readily from other seed of similar appearance); nearly

inodorous; taste bitter, acrid. *Solvents*: diluted alcohol; vinegar; wine. Dose, **CORM**, gr. 2–8 (.13–.5 Gm.); **SEED**, gr. 1–5 (.06–.3 Gm.).

## CONVALLARIACEÆ.

*Commercial.*—The entire plant has medicinal properties; resembles our garden tulip, and requires 2 years for the cycle of complete development. Planting the bulb in the spring, by fall a new cormus is formed on the lateral inferior portion of the old one, this latter still embracing it half around; the new cormus takes the place of the old one, sending downward roots and upward a spathe from which in Sept.—Oct. emerge flowers, but as yet no leaves; the lower corolla-tube is underground, whitish, perishing by Nov., the fruit rudiment (ovary) remains underground until following spring, when it rises on stem in shape of a 3-lobed, 3-celled capsule, bringing along with it the first leaves; the corm is most active when a year old, and should be collected June—Aug. of second year, after seeds are ripe and just before the sprouting forth of the fall flowers from newly forming cormus; it is then most developed and least exhausted from the formation of new

FIG. 47.



Colchicum corm (tuber): front and rear view; also transverse section.

bud and soon to be evolved corm, provided it be left in the ground. It is now dug, washed, sliced, and dried by sun or fire ( $65^{\circ}\text{C.}$ ;  $150^{\circ}\text{F.}$ ). These corms resemble tulip bulbs, except the latter are made up of concentric scales; the loss upon drying is 70 p. c. The seeds are the most concentrated portion of plant; should be collected when fully ripe, July—Aug. Their horny albumin renders powdering difficult, which is accomplished best in a mill with hardened plates; if pestle and mortar used, seeds must be very dry or be macerated in their menstruum to soften, so as to mash easily. Unless very fine, cold solvents extract only one-third of their colchicine, but hot solvents exhaust irrespective of fineness. England and Germany furnish our supply, the quality being usually determined simply by the degree of bitterness.

**CONSTITUENTS.**—Colchicine 0.5 p. c., (Colchicine), Colchicoresin, Beta-colchicoresin, starch, sugar, fixed oil (seeds 5–6 p. c.), gum, ash 2.6 p. c.

**Colchicina, Colchicine,  $\text{C}_{22}\text{H}_{25}\text{NO}_6$ , official.** (Syn., Fr. Colchicine; Ger. Colchicin.).—This alkaloid is prepared by exhausting seed with hot alcohol, recovering latter, adding water (to remove resin, fat, wax), shaking from brown filtrate with 4 portions chloroform, mixing these, distilling, dissolving residue in water, shaking with chloroform, evaporating last solution, thereby getting crude colchicine-chloroform; dissolve in alcohol,

FIG. 48.



Colchicum seed: a, natural size; b, section magnified.

evaporate, treat with warm ether, crystallize, heat crystals with water, evaporate. It is in pale yellow leaflets, or amorphous powder, darker with age, odor of damp hay, very bitter taste, soluble in alcohol, chloroform, 22 parts water, 155 ether, 87 benzene, insoluble in petroleum benzin, levogyrate, no residue. *Tests*: 1. Sulphuric acid gives citron-yellow color, + 1 drop nitric acid changes to greenish-blue, then to red, yellow, + potassium hydroxide get red. 2. Ferric chloride T. S. + aqueous solution gives no color, but upon heating brownish-red to brownish-black; + alcoholic solution get garnet-red. 3. Sulphuric acid + potassium dichromate crystal gives greenish-blue, orange; this and its salicylate are the best forms for general use. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{160}$ – $\frac{1}{120}$  (.0004–.0005 Gm.).

**Colchicine**,  $C_{21}H_{23}NO_6 + \frac{1}{2}H_2O$ .—Not in drug, but produced as a result of hydrolysis in percolating with acid menstrua; readily converted into colchicine by etherification with methyl alcohol and hydrochloric acid, or with methyl iodide + sodium hydroxide in methyl alcohol; with mineral acids splits into acetic acid, methyl alcohol, and apocolchicine; it occurs in white crystals, non-toxic, inodorous, soluble in alcohol, chloroform, hot water, also in alkalies and their carbonates giving yellow solutions.

**Colchicoresin**,  $C_{31}H_{60}N_2O_{15}$ .—Brown, amorphous, soluble in chloroform, alcohol; insoluble in ether, sparingly in cold water.

**Beta-colchicoresin**,  $C_{34}H_{39}NO_{10}$ .—Blackish-brown, soluble in chloroform, strong alcohol; insoluble in water or ether. These last 2 are affected but slightly by tannin, are brownish-green by ferric chloride, and dissolve in potassium hydroxide with a brown color.

**Assay**: Exhaust 10 Gm. powdered corm or seed, with alkaline (ammonia 3) mixture of ether (77), chloroform (25), alcohol (8) 100 Cc., evaporate 50 Cc. of filtered tincture nearly to dryness, dissolve in ether 10, add water 5, stir well, evaporate off ether, shake remaining aqueous solution with chloroform 15, 10, 10, 10, evaporate chloroform solutions, dissolve residue in alcohol, evaporate, redissolve in ether 5, add water 5, stir, evaporate off ether, shake out aqueous filtrate with chloroform 15, 10, 10, 10, evaporate, dissolve in alcohol, evaporate to dryness, multiply weight of residue by 20, = p. c. of colchicine present.

**PREPARATIONS**.—I. CORM: 1. *Extractum Colchici Cormi*. Extract of Colchicum Corm. (Syn., *Extractum Colchici Radicis*, U. S. P. 1890, Acetic Extract of Colchicum; Br. *Extractum Colchici (Aceticum)*; Fr. *Extrait de Colchique acétique*; Ger. *Zeitlosen Essigextrakt*.)

**Manufacture**: Macerate, percolate 100 Gm. with acetic acid 35 Cc., water 150, finishing with latter q. s., evaporate; contains 1.4 p. c. of colchicine, and any excess of strength must be reduced with sufficient sugar of milk. **Assay**: Dissolve extract (4) in distilled water (20), add alcohol q. s. 100 Cc., collect and treat 50 Cc. as in assay of colchicum corm or seed. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

II. SEED: 1. *Fluidextractum Colchici Seminis*. Fluidextract of Colchicum Seed. (Syn., *Extractum Colchici Seminis Fluidum*,

**CONVALLARIACEÆ.**

U. S. P. 1890 ; Fr. Extrait liquide de Semence de Colchique ; Ger. Flüssiges Zeitlosensamenextrakt.)

*Manufacture* : Macerate, percolate 100 Gm. with alcohol 65 p. c., q. s., evaporate to 100 Cc. ; when assayed each 100 Cc. should contain 0.5 Gm. of colchicine. *Assay* : To 10 Cc. add ammonia water 1, shake out with chloroform, 15, 15, 10, evaporate chloroformic solutions to dryness, proceed approximately as in assay of colchicum seed. Dose,  $\mathfrak{Mj}$ –5 (.06–.3 Cc.).

2. *Tinctura Colchici Seminis*. Tincture of Colchicum Seed. (Syn., *Tinctura Colchici* ; Fr. Teinture (de Semences) de Colchique ; Ger. *Tinctura Colchici* ; Zeitlosentinktur.)

*Manufacture* : 10 p. c. Macerate, percolate 10 Gm. with alcohol 60 p. c., q. s. 100 Cc. Dose,  $\mathfrak{Mx}$ –30 (.6–2 Cc.).

3. *Vinum Colchici Seminis*. Wine of Colchicum Seed. (Syn., Fr. Vin (CEnole) de Semence de Colchique ; Ger. *Vinum Colchici*, Zeitlosen(samen)wein.)

*Manufacture* : 10 p. c. Mix fluidextract of colchicum seed 10 Cc., alcohol 15, white wine 75, set aside 2 days, filter in a well-covered funnel. Dose,  $\mathfrak{Mx}$ –30 (.6–2 Cc.).

*Unoff. Preps.* : CORM : *Fluidextract*, dose,  $\mathfrak{Mij}$ –8 (.13–.5 Cc.). *Wine*, 10 p. c., dose,  $\mathfrak{Mv}$ –15 (.3–1 Cc.).

**PROPERTIES.**—Alterative, cathartic, emetic, sedative, diuretic, diaphoretic, gastro-intestinal irritant. Small doses increase secretions generally (urine, sweat, etc.) ; normal doses produce only pains and loose bowels, having little or no effect on nervous system, circulation, respiration, or temperature.

**USES.**—Gout, rheumatism, especially if neuralgic, increases urica and uric acid elimination from blood, prurigo, urticaria, other gouty cutaneous troubles. Should be given with an alkali, pushing it just short of nausea, and before beginning with it the bowels should be moved with magnesium sulphate, oxide, or carbonate. Repeated attacks render larger doses necessary, and it may lose entirely its effect. Colchicum was used by the ancients in gout, etc., but falling into disfavor was revived by Störck as a diuretic, expectorant in dropsy, asthma. Again growing into odium, became reestablished by Want, who thought it a component of *Eau médicinale d'Husson*, a celebrated gout cure.

*Poisoning* : Have persistent purging, tenesmus, nausea, vomiting, thirst, pain in throat, œsophagus, and stomach, suppressed urine, pinched face, dilated pupils, salivation, cold extremities, weak pulse, prostration, headache, delirium, spasms, stupor, death by gastro-enteritis or cardiac paralysis, conscious until the last. Evacuate stomach, if not already done, give tannin, morphine, demulcent drinks, stimulants, heat to extremities, hot abdominal fomentations, castor oil.

*Incompatibles* : Alcohol, opium (antagonizes cardiac depression), tannin, vegetable infusions. *Synergists* : Diuretics, purgatives, emetics, alkalies.

*Allied Plant* :

1. *Colchicum variegatum*, *Oriental Hermodactyls*.—S. Europe, Asia

Minor. Corm like official, but surface smooth, whitish to black, bitter, insipid.

## 12. SMILACEÆ. Smilax Family

**Smi-la'se-e.** L. *Smil-ax* + aceæ, fr. Gr. *σμίλη*, a scraper—i. e., alluding to the rough, prickly stems. Mostly vines, woody or herbaceous, stems often prickly. Distinguished by 3–5-nerved (net-veined) leaves, punctate; flowers 6's, umbels, anthers 2-celled, extrorse, ovary 3-celled; fruit globose-berry containing 1–6 brownish seeds; warm and temperate climates; alterative, diuretic, diaphoretic.

Genus: 1. **Smilax**.

## SARSAPARILLA. SARSAPARILLA.

**Smilax** { **medica**, Chamisso et Schlechtendal,  
**ornata**, Hooker filius,  
**papyracea**, Duhamel,  
**officinalis**, Kunth. } The dried root.

**Habitat.** Tropical America, Mexico to Brazil; swampy forests.

**Syn.** 1. Mexican, Vera Cruz, Tampico Sarsaparilla. 2. Jamaica, C. America, Costa Rica, Lima Sarsaparilla. 3. Brazilian, Para, Rio Negro Sarsaparilla. 4. Honduras Sarsaparilla. Br. *Sarsæ Radix*; Fr. *Salsepareille*; Ger. *Radix Sarsaparillæ*, *Sarsaparille*.

**Smi'lax.** L. Bindweed, Gr. *σμίλαξ*, the yew, fr. *σμίλη* (Eng. smile), a scraper—i. e., stems rough with prickles.

**Med'i-ca.** L. *medicus*, medical, curative—i. e., its healing properties.

**Or-na'ta.** L. *ornatus*, fr. *ornare*, to adorn—adorned, decorated, ornamented—i. e., beautiful fruit and foliage.

**Pap-y-ra'ce-a.** L. *papyraceus*, fr. *papyrus*—i. e., leaves and pith may be used to write upon.

**Of-fi-ci-na'lis.** L. see etymology of (*Asagracea*) *officinalis*, page 101.

**Sar-sa-pa-ri'l'a.** L. fr. Sp. *sarsaparilla*—*zarza*, a bramble, <sup>1</sup> *parra*, a vine, or from *Parillo*, a physician said to have discovered and employed it.

**PLANTS.**—Large perennial climbers; rhizomes short, thick, knotted, nodes thick, from which spring purplish-white roots 2–2.5 M. (6–8°) long, and a few rootlets; stems many, stiff, woody, angular, ridged, subterete or quadrangular, prickles at nodes; leaves 10–30 Cm. (4–12') long, 7.5–15 Cm. (3–6') wide, petioles 5 Cm. (2') long, quadrangular, cordate, rounded lobes at base, entire, glabrous, leathery, dark glossy green; flowers diœcious, 10–20 together in umbels; fruit small berry, 8 Mm. ( $\frac{1}{3}$ ') thick, red, 2–3-seeded. **ROOT**, usually more than 1 M. (3°) long, 4–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') thick, with few or many fine roots adhering, varying from light gray-brown and smooth, with few deep sharp wrinkles, to dark or orange-brown and less smooth, with more and smaller wrinkles, internally whitish, with a thick, mealy or sometimes horny cortex, a circular wood-zone, thick pith, fracture tough; nearly inodorous; taste mucilaginous, somewhat sweetish, bitter, slightly acrid; the thick, woody, knotty rhizome should be rejected. **Solvents**: diluted alcohol or boiling water extracts the virtues, which are injured by continued boiling. **Dose**, ʒss–2 (2–8 Gm.).

**Commercial.**—Sarsaparilla was carried to Europe from Peru, St.

**SMILACEÆ.**

Domingo, Brazil, by the Spaniards in 1550, and has been used generally ever since.

*S. medica*.—Mexican, Vera Cruz Sarsaparilla; grows in Mexican Andes, around Orizaba, Vera Cruz, etc., considered a variety of *S. officinalis*, with slender branches and frequently no prickles.

*S. ornata*.—Jamaica, C. America Sarsaparilla; grows chiefly in Costa Rica, being called "Jamaica" from the fact of its exportation through that province.

FIG. 49.



Smilax: branch with flowers and fruit.

*S. papyracea*.—Brazilian, Para Sarsaparilla; grows in N. Brazil, Guiana, considered a variety of *S. officinalis*, with older stems, lower branches remaining square, angles with flattened prickles, leaves much more membranaceous.

*S. officinalis*.—Honduras Sarsaparilla; grows in Honduras, Guatemala, Peru, Colombia, C. America on Chiriqui Mountains, 1,200–2,400 M. (4,000–8,000°) elevation. Besides these the root is taken from *S. syphilitica* (Colombia), *S. glauca* (Mexico), *S. utilis* (Jamaica), etc.,

all being collected by grubbing, pulling, etc., taking care to leave sufficient at each plant to insure future growth; most roots are of horizontal and shallow growth, yet so numerous, so matted, and amidst such thick undergrowth, that careful digging is troublesome. Full-grown plants often yield at first cutting 30–60 pounds (13.6–27 Kg.), and every two years thereafter smaller quantities of more slender and less starchy roots. Collectors recognize as best that having many roots from stem, persistent acrid taste, prickles closely set, leaves thin. We have two varieties dependent upon physical properties: 1. *Non-mealy*; 2. *Mealy*; and each has subdivisions named according to growing- or shipping-point; the latter is more or less swollen, pale yellow, transversely cracked, starch considerable, usually in fine granules, seldom pasty; the former thin, not cracked, red or brown, starch little if any, usually pasty, rarely in granules, more horny, with longitudinal and irregular folds; this is considered best, as roots produce a greater number of rootlets, are more acrid, and yield most extract, which is dissolved entirely by cold water, forming a clear solution.

*To the non-mealy belong:*

1. *Mexican, Vera Cruz, Tampico (S. medica)*.—Consists of rhizome with numerous long roots folded back over it, to which stem portions

FIG. 50.

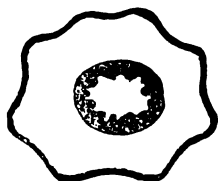


Mexican sarsaparilla.

are often adherent; conical shape, not tied by convolutions, each one separate, pith and woody zone equal thickness, once thought valueless, but owing to acidity now considered valuable, is often filled with earth.

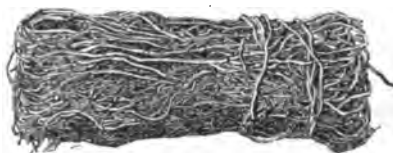
2. *Jamaica, C. America, Costa Rica, Lima, Red (S. ornata)*.—Mostly from Costa Rica; resembles Honduras, but redder, less amylaceous, and yields more extract; occurs in loose bundles .3–.5 M. (12–18')

FIG. 51.



Mexican sarsaparilla: cross-section: magnified 3 diam.

FIG. 52.



Jamaica sarsaparilla.

long, 10–12.5 Cm. (4–5') thick, composed of long, slender roots folded up, with many attached fibres (bearded sarsaparilla), little wrinkled; considerable from Amazon Valley.

## SMILACEÆ.

To the mealy belong :

1. *Honduras (S. officinalis)*.—The most popular here, comes from Honduras Bay in subcylindrical bundles, .6–1 M. ( $2-3^{\circ}$ ) long, composed of several roots folded lengthwise and fastened by a few circular turns ; in bales or skins 100 pounds (45.3 Kg.) or more each ; amylaceous when broken.

FIG. 53.



Honduras sarsaparilla.

2. *Brazilian, Para, Rio Negro, Lisbon (S. papyracea)*.—Not plentiful, from Para, Maranhão, in cylindrical bundles, .3–1.5 M. ( $1-5^{\circ}$ ) long, 20–30 Cm. (8–12') thick, closely, neatly wrapped with a climbing plant stem, evenly cut off at both ends, rootlets few, interior very amylaceous, acrid.

3. *Guayaquil (S. officinalis)*.—Grows in W. Andes valleys, usually

FIG. 54.

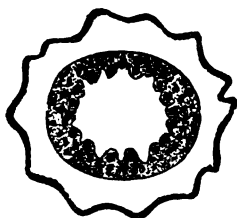
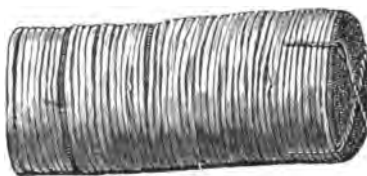
Honduras sarsaparilla: cross-section ;  
magnified 3 diam.

FIG. 55.



Rio Negro sarsaparilla.

loose and carelessly packed in bales, rhizome and stem portions often present, roots dark with much fibre, bark furrowed, thick, more or less amylaceous, inside pale yellow.

**CONSTITUENTS.**—Parillin 0.2 p. c., Saponin, Sarsa-saponin, volatile oil, resin, starch, coloring matter, calcium oxalate and other salts.

**Parillin** (*smilacin, parillic acid, pariglin, salseparin, parillinic acid*),  $C_{28}H_{44}O_{10} + 2\frac{1}{2}H_2O$ .—Obtained by exhausting with warm alcohol, distilling to  $\frac{1}{2}$  weight of root taken, adding  $1\frac{1}{2}$  times weight of water, after several days decant from yellow precipitate, which mix with  $\frac{1}{2}$  volume alcohol and wash on filter with 20 p. c. alcohol. It is a white glucoside resembling saponin, bitter when dissolved in alcohol or water, frothing when agitated, with sulphuric acid gives yellow solution, turning cherry-red ; aqueous solutions precipitated by lead acetates, tannin ; boiled with diluted acids splits into sugar and parigenin.

**Saponin**,  $5(C_{20}H_{32}O_{10} + 2\frac{1}{2}H_2O)$ .—Glucoside, soluble in water.

**Sarsa-saponin**,  $12(C_{22}H_{36}O_{10} + 2H_2O)$ .—Glucoside, soluble in water, alcohol, crystallizable ; most important and toxic of all constituents.



PREPARATIONS.—1. *Fluidextractum Sarsaparillæ*. Fluidextract of Sarsaparilla. (Syn., *Extractum Sarsaparillæ Fluidum*, U. S. P. 1890; Br. *Extractum Sarsæ Liquidum*; Fr. *Extrait Liquide de Salsepareille*; Ger. *Flüssiges Sarsaparillaextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 35 p. c., q. s., evaporate to 100 Cc. Dose, 3ss–1 (2–4 Cc.).

Prep. 1. *Syrupus Sarsaparillæ Compositus*. Compound Syrup of Sarsaparilla. (Syn., *Syrupus Sudorificus*; Fr. *Sirop de Salsepareille composé*, *Sirop sudorifique*; Ger. *Zusammengesetzter Sarsaparillsirup*.)

*Manufacture*: Fluidextract of sarsaparilla 20 Cc., fluidextract of glycyrrhiza 1.5, fluidextract of senna 1.5, sugar 65 Gm., oil of sassafras .02 Cc., oil of anise .02, oil of gaultheria .02, water q. s. 100 Cc. Dose, ʒj–4 (4–15 Cc.).

3. *Fluidextractum Sarsaparillæ Compositum*. Compound Fluidextract of Sarsaparilla. (Syn., *Extractum Sarsaparillæ Fluidum Compositum*, U. S. P. 1890; Fr. *Extrait liquide de Salsepareille composé*; Ger. *Zusammengesetztes Flüssiges Sarsaparillaextrakt*.)

*Manufacture*: 75 p. c. Macerate, percolate sarsaparilla 75 Gm., glycyrrhiza 12, sassafras 10, mezereum 3, with glycerin 10 Cc., diluted alcohol 90, finishing with latter alone q. s., evaporate to 100 Cc. Dose, 3ss–1 (2–4 Cc.).

*Unoff. Preps.*: *Compound Decoction* 10 p. c. (+ sassafras 2, guaiacum wood 2, glycyrrhiza 2, mezereum 1), dose, ʒj–4 (30–120 Cc.). *Extract*, dose, gr. 5–10 (.3–6 Gm.). *Extract Comp.* *Decoction.* *Syrup.*

PROPERTIES.—Alterative, diuretic, diaphoretic, tonic. Mostly believed to be of little service unless associated with other drugs, such as potassium iodide, guaiac, sassafras, mezereum, etc.

USES.—As a blood purifier in scrofula, cutaneous diseases, abscesses, ulcers, tertiary syphilis with mercuric chloride or potassium iodide or both; gout, rheumatism.

*Incompatibles*: Alkalies, iodine, and corrosive sublimate is claimed to be converted into calomel by the compound syrup.

*Allied Plants*:

1. *Smilax chi'na*, *S. pseu'do-chi'na*, *S. tam-noi'des*, and *S. as'pera*.

2. *Ca'rex arena'ria*, *German Sarsaparilla*. —All used like official.

3. *I'ris versic'olor*, *Blue Flag*.—Iridaceæ. The rhizome and roots, official 1820–1900; N. America (swampy places). Perennial herb, .6–1 M. (2–3°) high; stem angled on one side, branched, bearing 2–6 beautiful, purplish-blue flowers; leaves long, sword-shaped. Rhizome, 5–10 Cm. (2–4') long, jointed, annulated, 20 Mm. ( $\frac{4}{5}$ ') broad, sub-cylindrical, grayish-brown; odor slight; taste acrid, nauseous; contains resin 25 p. c., camphoraceous body, alkaloid (?), fat, sugar, gum, tannin.

FIG. 56.



Iris in bloom.

**SMILACEÆ.**

Cholagogue cathartic, emetic, diuretic, alterative; costiveness, malarial jaundice, bilious remittent fever, dropsy, but is very nauseating and prostrating; less irritating than podophyllum, more purgative than euonymus. Dose, gr. 5–20 (.3–1.3 Gm.); extract, gr. 1–4 (.06–.26 Gm.); fluidextract (alcohol), ℥v–20 (.3–1.3 Cc.); irisin or iridin ("Eclectic" oleoresin or resinoid), gr. 1–4 (.06–.26 Gm.).

4. *I. florenti'na*, *Florentine Orris* (*White Flag*).—The rhizome, official 1820–1880. N. Italy (near Florence), Germany, France. Per-

FIG. 57.

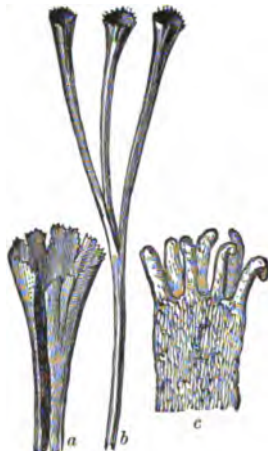
*Iris versicolor*: joint of rhizome and section of branches.

ennial plant, leaves radical, sword-shaped, shorter than stem, which rises in their midst (.3–.6 M.; 1–2°) high, bearing 2 large white or

FIG. 58.

*Crocus sativus*.

FIG. 59.



Crocus; a, stigma, upper part, magnified 4 diam.; b, style with stigmas; c, papillose margin of stigma, magnified 120 diam.

bluish flowers; fruit capsule, 3-celled, many-seeded; rhizome 5–10 Cm. (2–4') long, 12–18 Mm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') thick, flattish, peeled, whitish, on upper side fibro-vascular bundles, below many brownish scars of roots, fracture short; odor violet-like; taste mealy, bitter, acrid; contains volatile oil, starch, resin, tannin. Used as stimulant, diuretic, emetic,

cathartic; fresh root irritant, for diarrhoea, bronchitis, dropsy, masticatory for perfuming breath and teething infants; for this latter the more slender pieces are peeled smoothly and whitened with chalk or magnesium oxide. This is adulterated with the rhizomes of *I. pallida*, *I. germanica*, *I. pseudacorus*, *I. fetidisima*, all of which are somewhat darker, more astringent and acrid.

5. *Crocus sativus*, *Saffron*.—Iridaceæ. The stigmas, official 1820–1900; W. Asia, Spain, France. Perennial herb with solid, depressed-globular corm (bulb), 2.5 Cm. (1') thick; flowers lilac, bluish-purple. Stigmas, 3-cleft, convolute, orange-red, 3 Cm. (1½') long, tubular, notched above, odor peculiar, aromatic, bitter; contains volatile oil, crocin, picrosin, fixed oil. Largely adulterated with florets, dyed stamens, petals, mineral matter, etc.—20–40 p. c. There are three varieties: 1. Spanish (French); 2. Grecian; 3. Chinese; known as *hay saffron*, as distinguished from *cake saffron*, which is no longer in commerce. Diaphoretic, carminative, emmenagogue, anodyne; to promote exanthematous eruptions in measles, etc., dysmenorrhœa, conjunctivitis. Dose, gr. 5–30 (.3–2 Gm.); tincture, 10 p. c. (diluted alcohol), ʒj–2 (4–8 Cc.); infusion (tea), 2 p. c., ʒij–4 (60–120 Cc.).

### 13. ZINGIBERACEÆ. Ginger Family.

Zin-ji-be-ra-se-e. L. *Zingiber* + aceæ, fr. Gr. ζῆγγιβερίς, ginger. Herbs. Distinguished by being aromatic, with creeping rhizomes; leaves stalked, broad, sheathing, parallel veins from midrib. Perianth superior, irregular. Each whorl 3, stamens 6, in 2 whorls, outer staminal staminodial or absent; ovary 3-celled, inferior; fruit 1–3-celled, capsule or berry; seeds many, arillate; tropics; stimulant; aromatic, stomachic (resin + vol. oil), starch, food.

Genera: 1. *Elettaria*. 2. *Zingiber*.

### CARDAMOMUM. CARDAMOM.

*Elettaria repens*, (Sonnerat) Baillon. } The dried, nearly ripe fruit.  
(*Elettaria Cardamomum*, Maton.) }

*Habitat*. Malabar, cultivated. India, Mountains, 750–1,500 M. (2,500–5,000°) elevation; Ceylon, Annam, Siam.

*Syn*. Malabar, Ceylon or Bastard Cardamom; Br. Cardamomi Semina, Cardamomum (Minus) Malabari (am)-cum; Fr. Cardamomes, Petit Cardamome; Ger. Fructus (Semen) Cardamomi (Minoris), Malabar-(Malabarische) Kardamomen, Kleine Kardamomen.

*El-et-ta'ri-a*. L. fr. *Elettaria*—i. e., native name of plant in Malabar.

*Re'pens*. L. fr. *repo*, creep—i. e., stem inclines to crawl on ground.

*Car-da-mo'mum*. L. fr. Gr. κάρδος, thistle, + ἄμωμος, blameless, classic name.

**PLANT**.—Perennial herb; stems green, 2–4 M. (6–12°) high, tapering, shining, covered with leaf-sheaths; leaves .3–.8 M. (1–2½°) long, 2.5–12.5 Cm. (1–5') broad, lanceolate, flower stalk from stem base lies upon the ground; flowers greenish-white occurring in rainy season; rhizome tuberous, woody, fibrous roots below, scars above.

**ZINGIBERACEÆ.**

FRUIT, oblong-ovoid, 10–20 Mm. ( $\frac{2}{3}$ – $\frac{4}{5}$ ') long, 6 Mm. ( $\frac{1}{4}$ ') broad, obtusely triangular in transverse section, slightly beaked at apex, rounded

FIG. 60.



*Ellettaria repens*: A, leaf with ligule, b; B, bracts; C, flower, natural size; D, flower, with calyx and corolla-tube partially removed; E, G, capsule form; H, seed with arillus, a; J, cross-section of seed 8 times enlarged; K, longitudinal section 5 times enlarged; p, perisperm; em, embryo; e, endosperm.

to truncate at base, 3-celled, central placentæ; pericarp thin, leathery, nearly tasteless, pale yellow; seeds 15–18, reddish-brown, 4 Mm. ( $\frac{1}{6}$ ') long, 3 Mm. ( $\frac{1}{8}$ ') broad, oblong-ovoid, irregularly angular, enclosed in

a thin, membranous aril; odor and taste strongly, agreeably aromatic. Seeds alone contain active and valuable constituents, constitute 75 p. c. by weight, and keep best in pericarp, which (latter) should be rejected when for medicinal use. *Solvents*: diluted alcohol; boiling water. Dose, gr. 5–15 (.3–1 Gm.).

**ADULTERATIONS.**—**FRUIT**: Fruits of various varieties, also orange seeds, green coffee, etc.; **POWDER**: Starch, sodium carbonate, etc.

*Commercial.*—Plants grow on spaces cleared in mountain forests which afford shade, or on betel-nut plantations of W. Mysore, and yield the fourth year, and for quite a number thereafter. The fruit is gathered usually just before maturing in order to lessen rupturing in curing, beginning in October and continuing the dry weather of 2–3 months; it is collected in several ways; the entire scape may be cut, though it contains fruit of variable ripeness, or only ripe fruits are plucked, then dried by sun or fire, or scapes may be cut, carried to houses, cured several days, assorted, and dried by fires. After this the fruit is bleached by moistening, exposing to dew and sunlight, or sulphurous acid, the finest being whitened by washing with alternating solutions of lathery soap-berry and astringent acacia pods, then soap-suds and water; finally dried in the sun. We have several varieties: 1. *Shorts*, 12 Mm. ( $\frac{1}{2}$ ') long, 6 Mm. ( $\frac{1}{4}$ ') broad, plump, heavy. 2. *Short-longs* (medium), 18–25 Mm. ( $\frac{3}{4}$ –1') long, 6 Mm. ( $\frac{1}{4}$ ') broad, paler buff, finer ribbed than shorts. 3. *Long (longs)*, 25–31 Mm. (1–1 $\frac{1}{4}$ ') long, 4 Mm. ( $\frac{1}{8}$ ') broad, rarely imported. The growing districts and shipping ports also furnish variety names: 1. *Aleppi, Mysore, Calicut*, same as shorts, greenish tint. 2. *Malabar*, shorts and short-longs, best; shipped via Bombay. 3. *Madras*, usually short-longs, pale buff; shipped via Madras and Pondicherry. 4. *Mangalore*. The *Ceylons* are the wild-grown fruits of Ceylon, and the *Siam* of Cochin, Annam and Tonquin (Tonking) combined; the shorts of all varieties are best and most desired. They are imported in chests of 60–100–200 pounds (27–46–91 Kg.).

FIG. 61.



Malabar cardamom: a, short; b, medium; c, long.

FIG. 62.



Cardamom seed: transverse and longitudinal section, magnified 5 diam.

**CONSTITUENTS.**—Volatile oil 5 p. c., fixed oil 10 p. c., potassium salts 2.5 p. c., starch 3 p. c., nitrogenous mucilage 1.8 p. c., yellow coloring-matter 0.4 p. c., ligneous fibre 77.3 p. c., manganese 0.8 p. c., ash 6–15 p. c.

**Volatile Oil.**—Mostly in the testa; has odor and taste of the drug, somewhat camphoraceous, sp. gr. 0.900. Contains terpinene,  $C_{10}H_{16}$ .

## ZINGIBERACEÆ.

possibly dipentene, a body of the composition  $C_{10}H_{18}O$  (terpineol?), and acetic and formic acids. It is obtained by distillation or extraction with ether. The latter method gives more durable oil, but one mixed with fixed oil, it being soluble also in ether; this latter, however, may readily be separated. The distilled oil easily deteriorates by age.

PREPARATIONS.—1. *Tinctura Cardamomi*. Tincture of Cardamom. (Syn., Fr. Teinture de Cardamome; Ger. Kardamomentinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with diluted alcohol q. s. 100 Cc. Dose, ʒj–2 (4–8 Cc.).

2. *Tinctura Cardamomi Composita*. Compound Tincture of Cardamom. (Syn., Fr. Teinture de Cardamome composée; Ger. Zusammengesetzte Kardamomentinktur.)

*Manufacture*: 2.5 p. c. Macerate 7 days, occasionally agitating, cardamom 2.5 Gm., saigon cinnamon 2.5, caraway 1.2, cochineal .5, with diluted alcohol 95 Cc. + glycerin 5, filter, adding diluted alcohol q. s. 100 Cc. Dose, ʒj–2 (4–8 Cc.).

3. *Extractum Colocynthis Compositum*, 6 p. c. 4. *Pulvis Aromaticus*, 15 p. c. 5. *Tinctura Gentianæ Composita*, 1 p. c. 6. *Tinctura Rhei*, 4 p. c.

*Unoff. Preps.*: *Infusion*, dose, ʒj–2 (30–60 Cc.). *Compound Infusion*. *Fluidextract*.

PROPERTIES.—Carminative, stomachic, stimulant, aromatic, condiment.

USES.—Adjuvant or corrective to cordials, tonics, purgatives, flavoring liquors, cakes, breath, etc.

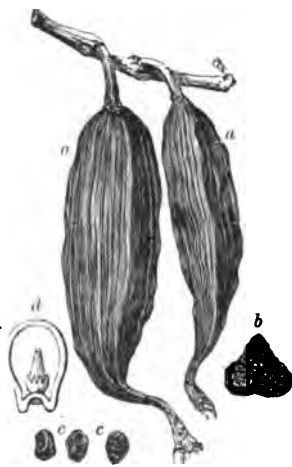
*Allied Plants*:

1. *Elettaria majior*, *Ceylon Cardamom*.—40 Mm. ( $1\frac{3}{8}$ ') long, triangular, prolonged into a beak 15 Mm. ( $\frac{3}{8}$ ') long, brownish-gray color.

2. *Amomum Cardamomum*, *A. verum* and *A. globosum*, *Round Cardamom*.—Siam, Java, China; globular-ovate. *A. aromaticum*, *Bengal Cardamom*, 9-winged at apex. *A. xanthoides*, *Wild or Bastard Cardamom*, *A. maximum*, *Java Winged Cardamom*, 9–12-winged from base to apex, and *A. Granum-paradisii*, *Grain of Paradise*. Fruit resemble cardamom seeds, several varieties, used for ginger.

3. *Maranta arundinacea*, *Arrow-root*.—The fecula of the rhizome, official 1820–1880. W. Indies, Bermudas, Brazil. Plant slender, 1–2 M. (3–6°) high, leaves 7.5–12.5 Cm. (3–5') long, lanceolate, flowers white, rhizome perennial, tuberous, fleshy, scaly, 15–30 Cm. (6–12') long. Arrow-root in powder or lumps 4 Mm. ( $\frac{1}{4}$ ') thick, white, opaque,

FIG. 63.



Ceylon cardamom; a, capsules; b, transverse section of capsule; c, seeds; d, section of seed with embryo; magnified.

under microscope consists of oval granules of fine-lined layers, nucleus at broad end. The rhizome when 1 or 2 years old is dug, washed, deprived of scales, ground under water, kneaded, strained, and the fecula allowed to subside; fresh rhizome yields starch 13–20 p. c. Root contains starch 27 p. c., fat 0.2 p. c. Used as demulcent, nutritive food for infants, convalescents, bowel or urinary troubles; in 5 p. c. solution with water or milk by boiling and flavoring with vanilla, lemon juice, etc.; also used in puddings. The jelly is more tenacious than that of all other starches, except Canna.

4. *Can'na ed'ulis*, *Canna* (*Tous-les-mois*).—The fecula of rhizome,

FIG. 64.



Maranta starch.

FIG. 65.



Canna starch.

official 1870–1880. Peru, Brazil. Perennial herb 2.5 M. ( $8^{\circ}$ ) high; stem green; leaves parallel-veined, bluish-green; flowers few, in pairs, red; yellow, purple bract; fruit round capsule, 12 Mm. ( $\frac{1}{2}'$ ) thick; rhizome creeping, fleshy, thick joints. Canna starch white powder, satiny, granules largest of all, potato coming next,  $\frac{1}{12}$ – $\frac{1}{8}$  Mm. ( $\frac{1}{300}$ – $\frac{1}{200}'$ ) long, flat, ovate, hilum at narrow end, encircled by many unequally distant rings. Grind rhizome under water, knead, strain, allow to subside. Used as demulcent, nutritive food for urinary and bowel affections, infants, invalids in convalescence.

## ZINGIBER. GINGER.

*Zingiber officinale*, *Roscoe*.  
(*Zingiber Zingiber*, (*Linné*) *Rusby*.) } The dried rhizome.

*Habitat*. India, Hindustan (cultivated in W. Indies, Africa).

*Syn*. Black, African or Race Ginger; Fr. Gingembre (gris et blanc); Ger. Rhizoma (Radix) Zingiberis, Ingwer.

*Zin'gi-ber*. L. fr. Skt. *gringavera*—*gringa*, horn, + *vera*, body, horn-shaped—i. e., shape of roots; Ar., Pers. *zanjabil*, *zenjebil*; Eng. *ginger*.

*Of-fi-ci-na'le*. L. *officina*, workshop; *opus*, work, + *facere*, to do—i. e., used in the shop or store.

PLANT.—Perennial herb; stem barren, leafy, 1–1.3 M. ( $3$ – $4^{\circ}$ ) high, entirely covered with the leaf-sheaths, solid, round; leaves 15–30 Cm. ( $6$ – $12'$ ) long, 2.5–4 Cm. ( $1$ – $1\frac{3}{8}'$ ) wide; flowering stalk from stem 15–30 Cm. ( $6$ – $12'$ ) long, terminating in a spike; flowers dingy yellow, 2–3 at a time. RHIZOME, 5–10 Cm. ( $2$ – $4'$ ) long, 12 Mm.



**ZINGIBERACEÆ.**

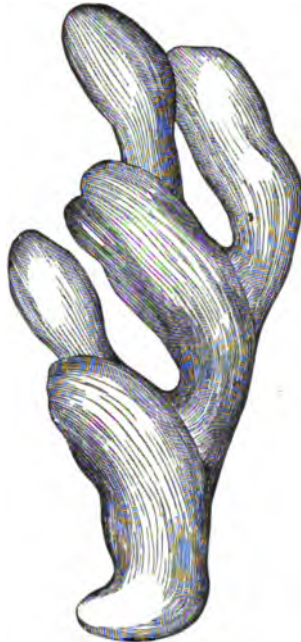
( $\frac{1}{2}$ ') broad, 4–8 Mm. ( $\frac{1}{8}$ – $\frac{1}{3}$ ') thick, laterally compressed, irregularly branched pieces, whitish or pale buff, longitudinally striate, fracture short-fibrous, mealy, showing numerous small oil and resin cells and circular groups of fibrovascular bundles; odor agreeably aromatic; taste aromatic, pungent. *Solvents*: alcohol or ether; boiling water partially. Dose, gr. 5–20 (.3–1.3 Gm.).

FIG. 66.



Zingiber: A, entire plant ( $\frac{1}{4}$  nat. size); B, flower; C, labellum; D, transverse section of ovary.

FIG. 67.



Jamaica ginger: uncoated.

**ADULTERATIONS.**—**RHIZOME**: Fibrous, light, friable, worm-eaten pieces (all to be rejected); **POWDER**: Rice starch, brick-dust, chalk, capsicum, mustard, and partially or wholly exhausted ginger.

*Commercial.*—Rhizomes are dug after stems have withered, January–February, when one or more years old, cleaned carefully to avoid bruising, hence discoloration, washed in boiling water to prevent germination, then rapidly dried, and as such constitute *black, coated, unpeeled* or *unscraped* ginger in contradistinction to the further prepared *white, uncoated, peeled, scraped, race*, or *hand ginger*—the former being richer and stronger. May bleach artificially by sulphur fumes, chlorinated lime, milk of lime, gypsum. We have several commercial varieties named after habitat:

1. *Jamaica*.—Official, deprived of epidermis, sometimes steeped in milk of lime, and covered with calcium carbonate, thus preventing insect attacks. Reaches us via England or direct from W. Indies.

2. *African*.—This is, as originally dried, covered with light brown



suberous tissue, rhizome shorter than official, lobes broadly linear or oblong; yields 8–10 p. c. oleoresin.

3. *E. India*.—Like African, or the edges may be coated and flat sides deprived of epidermis; reaches us via Calcutta; yields 8 p. c. oleoresin.

4. *Chinese, Cochín*.—Coated, rhizome shorter, lobes stumpy.

5. *Green*.—Lobed branches recently dug and marketed without drying.

6. *Preserved*.—Fresh rhizome steeped in hot syrup; it is soft, brown, yellow, translucent.

CONSTITUENTS.—Volatile oil 1–3 p. c., Gingerol .5–1.5 p. c., Resin (2), starch 20 p. c., mucilage, ash 4–5 p. c.

**Volatile Oil**.—Mostly  $C_{10}H_{16}$ , camphene and phellandrene; gives the peculiar flavor, pale yellow, ginger odor, aromatic, burning taste, sp. gr. 0.885.

**Gingerol**.—Not a glucoside, but a straw-colored, viscid, inodorous, pungent liquid, to which the hot taste is due; soluble in fat; volatile oil, alcohol, ether, slightly in benzin.

**Resin**.—Yields protocatechuic acid, and is partly acid and neutral.

PREPARATIONS.—1. *Fluidextractum Zingiberis*. Fluidextract of Ginger. (Syn., Extractum Zingiberis Fluidum, U. S. P. 1890; Fr. Extrait liquide de Gingembre; Ger. Flüssiges Ingwerextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\nu$ –20 (.3–1.3 Cc.).

Prep.: 1. *Syrupus Zingiberis*. Syrup of Ginger. (Syn., Fr. Sirop de Gingembre; Ger. Ingwersirup.)

*Manufacture*: Mix fluidextract of ginger 3 Cc., alcohol 2, triturate with magnesium carbonate 1 Gm., sugar 6, gradually add water 45 Cc., with constant trituration, filter; dissolve sugar 76 Gm. in clear filtrate by heat, strain, add water q. s. 100 Cc. Dose,  $\mathfrak{zss}$ –2 (2–8 Cc.).

FIG. 68.



East India ginger: coated.

2. *Oleoresina Zingiberis*. Oleoresin of Ginger. (Syn., Extractum Zingiberis Æthereum, Piperoid; Fr. Oléorésine (Piperoïde) de Gingembre; Ger. Zingiberin, Ätherisches Ingwerextrakt.)

*Manufacture*: Percolate 100 Gm. with acetone until exhausted, recover acetone by distillation on water-bath; yield 5–10 p. c. Should be kept in well-stoppered bottles. Dose,  $\mathfrak{mss}$ –2 (.03–.13 Cc.).

3. *Tinctura Zingiberis*. Tincture of Ginger. (Syn., Teinture de Gingembre; Ger. Ingwertinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol q. s. 100 Cc. Dose,  $\mathfrak{mxx}$ –60 (1.3–4 Cc.).

Prep.: 1. *Acidum Sulphuricum Aromaticum*, 5 p. c.

4. *Pulvis Aromaticus*, 35 p. c. 5. *Pulvis Rhei Compositus*, 10 p. c.

*Unoff. Preps.*: Infusion, dose,  $\mathfrak{ssj}$ –2 (30–60 Cc.). Troches.

PROPERTIES.—Like other aromatics, carminative, stimulant, sternu-

**ZINGIBERACEÆ.**

tatory, rubefacient, anodyne, sialagogue. This was introduced from Asia, through Arabia into Greece and Europe. The Arabian and Greek physicians used it as a condiment, carminative, stimulant, aphrodisiac.

**USES.**—Atonic dyspepsia, flatulent colic, atonic gout, diarrhœa, cholera, chronic bronchitis, corrective to nauseous medicines. Externally—colic, rheumatism, neuralgia, toothache, headache; in cataplasms, fomentations. The infusion for relaxed uvula, mas-ticated for paralysis of tongue.

*Allied Plants:*

1. *Zingiber Zerum'bet*.—Java (rhizome fleshy, spongy, ginger odor

FIG. 69.

Ginger starch gran-  
ules: magnified 250  
diam.

FIG. 70.



Turmeric rhizome and stem.

and taste), and *Z. Cassumu'nar*.—India (root 5 Cm. ; 2' long, fleshy radicles, white tubers, scaly, brown; odor and taste camphoraceous).

2. *Cur'cuma lon'ga*, *Turmeric*.—The rhizome, official 1820–1880. S. Asia, Indian Ocean Islands. Plant is a perennial; leaves radical, 1 M. ( $3^{\circ}$ ) long, lanceolate; flower-scape short, spike 15 Cm. (6') long, flowers orange-yellow, in pairs; rhizome 2.5–5 Cm. (1–2') long, 12 Mm. ( $\frac{1}{2}$ ') thick (long turmeric) to 18–25 Mm. ( $\frac{3}{4}$ –1') thick (round turmeric), sometimes in sections, yellowish-gray, annulate, inside orange-yellow, fracture resinous; odor ginger-like; taste warm, aromatic. Powder deep yellow, brownish-red by alkalis or borax. Have several varieties: 1. Chinese (best). 2. Bengal. 3. Madras. 4. Java. 5. Cochin-China. Contains volatile oil 1 p. c., viscid oil 11 p. c., pungent resin, curcumin (coloring matter) 0.3 p. c. Used as stimulant, tonic, aromatic, condiment, for jaundice, and as ginger. Tincture, 15 p. c. (diluted alcohol) for coloring ointments, solutions, etc.

3. *C. Zedoa'ria*, *Zedoary*.—India. Rhizome (tuber) occurs as *long* and *round*, varying in size, 12–37.5 Mm. ( $\frac{1}{2}$ – $1\frac{1}{2}$ ') long, usually met with in circular disks, 12–37.5 Mm. ( $\frac{1}{2}$ – $1\frac{1}{2}$ ') broad, 4–16 Mm. ( $\frac{1}{8}$ – $\frac{3}{4}$ ') thick; it is orange-brown, internally pale, reddish-gray-brown, with many brownish resin-cells and lighter colored wood-bundles; fracture short, mealy; odor and taste ginger-like; contains volatile oil 0.5–1 p. c., resin (to which pungent taste is due), starch, mucilage. Uses similar to ginger, but less effective. Dose, gr. 10–30 (.6–2 Gm.).

4. *Alpin'ia officina'rum*, *Galanga* (*Galangal*).—China. Rhizome cylindrical, branched, 5 Cm. (2') long, 15 Mm. ( $\frac{3}{8}$ ') thick, annulate from leaf-sheaths, rust-brown, fracture short, fibrous, inside yellowish, with many brownish resin-cells, scattered wood-bundles; odor and taste ginger-like; contains volatile oil 0.5 p. c., resin, gum, bassorin, fat, galangol, galangin, kæmpferid, alpinin, starch 23 p. c. Used like ginger in same dose.

5. *Al'teris farino'sa*, *Colic Root* (*Starwort*).—Rhizome, official 1820–1870. United States. Perennial, .6–1 M. ( $2$ – $3^{\circ}$ ) high; leaves radical, star-shaped, 7.5–10 Cm. (3–4') long, 2.5 Cm. (1') wide;

FIG. 71.



Curcuma starch.

FIG. 72.



Galanga.

flowers white, as though dusted with meal; rhizome 2.5 Cm. (1') long, 3 Mm. ( $\frac{1}{8}$ ') thick, upper side flattened, root whitish, taste amylaceous, bitter; contains starch, bitter principle. Used as tonic, diuretic, uterine tonic, emetic, purgative for colic, dropsy, chronic rheumatism; in fluid-extract, decoction, tincture. Dose, gr. 5–10 (.3–.6 Gm.).

## ORCHIDACEÆ.

## 14. ORCHIDACEÆ. Orchid Family.

Or-ki-da'se-e. L. *Orchi(s)d* + aceæ, fr. Gr. ὄρχις, a testicle—i. e., ancient name from shape of roots. Herbs or shrubs, terrestrial or epiphytical. Distinguished by flowers being perfect, irregular, reptile-shaped, perianth 6, in 2 whorls, petaloid, superior; leaves sheathing, entire; anthers 1-2, sessile, united to style (gynandrous); pollen cohering in masses; ovary 1-celled, inferior, long, 3-angled; capsule 3-valved; universal; aromatic, antispasmodic, nutrient, aphrodisiac, flavoring, beautiful flowers.

Genera: 1. *Cypripedium*. 2. *Vanilla*.

## CYPRIPIEDIUM. CYPRIPIEDIUM.

*Cypripedium* { *hirsutum* (*pubescens*), Miller, } The dried rhizome and  
                  { *parviflorum*, Salisbury. } roots.

*Habitat.* N. America (Can., U. S. to N. Ca.); in woods and swampy places.

*Syn.* Ladies' Slipper, Yellow Ladies' Slipper, Indian or Venus Shoe, Slipper, Umbel, or Nerve Root, Venus Cup, Moccasin Plant or Flower, Monkey Flower, Yellows, Bleeding Heart, Umble, Yellow Umbel or Noah's Ark, American Valerian, Male Nervine, Rhizoma Cypripedii; Fr. Racine de Cypripède jaune, Valériane américaine; Ger. Gelb-frauenschuhwurz.

*Cyp-ri-pe'di-um.* L. *Cypria*, Venus, + *pes, pedis*, foot; Gr. Κόρυς, Venus, + πόδος, foot, πόνος, a slipper—i. e., the slipper-like form of flower's lip.

*Hir-su'tum.* L. *hirsutus*, rough, hairy, bristly—i. e., stem, leaves, and inside of corolla possess this property.

*Pu-bes'cens.* L. *pubescens*(t)s, downy, hairy—i. e., stem, leaves, and inside of corolla, villous, hairy.

*Par-vi-fl'o-rum.* L. *parvus*, small, + *florus*, flower—i. e., the flowers smaller than the preceding, which, in turn, is usually called Large Yellow Ladies' Slipper.

**PLANTS.**—Herbaceous, perennial, hairy; stems .3-6 M. (1-2°) high; leaves many-nerved, plaited, sheathing at base, acute, broadly ovate, 10-12.5 Cm. (4-5') long, 5 Cm. (2') wide; flowers May-June, beautiful yellow, solitary, 4-divided, shaped like Indian moccasin, lip 2.5-5 Cm. (1-2') long. **RHIZOME**, of horizontal growth, curved, 3-10 Cm. (1½-4') long, 2-6 Mm. (¼-¼') thick, orange-brown to dark brown, upper side beset with many circular cup-shaped scars, under side covered closely with simple wavy roots, 3-15 Cm. (1½-6') long, fracture short, white, that of roots fibrous; odor distinct, heavy, valerian-like; taste sweetish, bitter, pungent; *C. parviflorum* has the shorter, thinner rhizome and orange-brown roots. The rhizome is collected shortly after flowering in the summer, washed, dried by sun and packed for market. *Solvents*: boiling water; diluted alcohol. Dose, gr. 15-30 (1-2 Gm.).

**ADULTERATIONS.**—*Hydrastis canadensis*, *Polygala Senega*, etc. All easily distinguishable by having finer roots, varying interior color, etc.

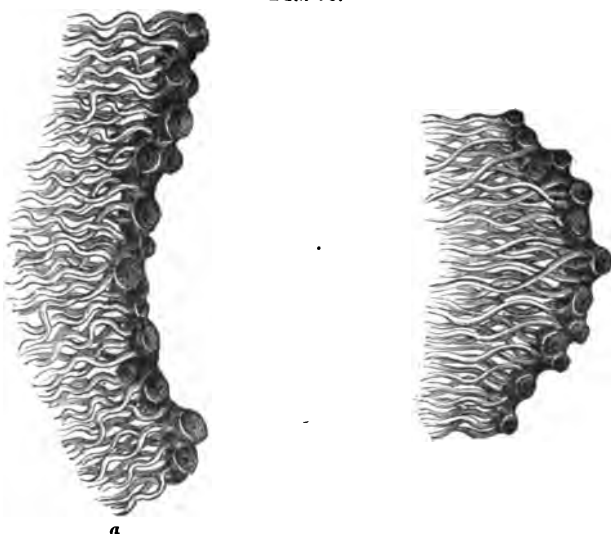
**CONSTITUENTS.**—Volatile oil, fixed oil, volatile acid, 2 resins, (tannin, starch, sugar, ash 6 p. c.).

The "Eclectics" prepare *cypripedin*, oleoresin, by precipitating concentrated alcoholic tincture with water; is a mixed substance and does not deserve the name. Dose, gr. 1-2 (.06-.13 Gm.). The virtues possibly reside in the volatile oil and an unnamed bitter principle (glucoside).

PREPARATIONS.—1. *Fluidextractum Cypripedii*. Fluidextract of Cypripedium. (Syn., Extractum Cypripedii Fluidum, U. S. P. 1890; Fr. Extrait liquide de Cypripède jaune; Ger. Flüssiges Gelbfrauen-schuhextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol, q. s., evaporate to 100 Cc. Dose, ℥xv–30 (1–2 Cc.).

FIG. 73.



a, *Cypripedium hirsutum (pubescens)*: rhizome and roots, natural size. b, *Cypripedium parviflorum*: rhizome and roots, natural size.

*Unoff. Preps.*: Extract, dose, gr. 2–6 (.13–.4 Gm.). Tincture, 10 p. c., dose, ʒj–2 (4–8 Cc.). Infusion, 5 p. c., dose, ʒj–2 (30–60 Cc.).

PROPERTIES.—Antispasmodic, diaphoretic, nervous stimulant.

USES.—Was popular with our aborigines and even at the present day as a substitute for valerian. Beneficial in chorea, hysteria, epilepsy, nervousness, hypochondriasis, neuralgia, insomnia.

## VANILLA. VANILLA.

*Vanilla planifolia*, Andrews. } The cured, full-grown, but immature fruit.

*Habitat*. E. Mexico, hot, damp woods, forests; cultivated in tropics.

*Syn.* Vanilla Aromatica, Vaniglia; Fr. Vanille; Ger. Fructus (Siliqua) Vanillæ.

**Va-nil'la**. L. fr. *Sp. vainilla*, formerly *raynilla*, dim. of *vaina (rayna)*, scabbard, sheath, pod, lit. "little pod"—i. e., pod resembling the sheath of a knife.

**Pla-ni-fo'li-a**. L. *planus*, flat, + *folium*, leaf, flat-leaved—i. e., leaves plain or flat, without prominent veins.

PLANT.—Succulent, dark green, epiphytic, terrestrial or parasitic, perennial climber; stem long, 1–2 Cm. ( $\frac{3}{8}$ – $\frac{1}{2}$ ') thick, smooth, much branched, nodes with aërial roots and rootlets, 12.5–15 Cm. (5–6') long, for clinging to trees, frame-work, etc.; leaves 10–15 Cm. (4–6') long, oval, tough, fleshy, veinless, dark green, paler beneath; flowers

**ORCHIDACEÆ.**

5 Cm. (2') across, pale yellowish-green, loose axillary racemes of 8–10. **FRUIT**, 15–25 Cm. (6–10') long, 8 Mm. ( $\frac{1}{3}$ ') thick, linear, narrowed, bent or hooked at the rather oblique base, blackish-brown, longitudinally wrinkled, glossy, frequently covered with an efflorescence of vanillin in acicular crystals, flexible, tough, 1-celled, containing a blackish-brown pulp and numerous minute, blackish ovoid flattened seeds; odor and taste characteristic, very agreeable. *Solvent*: alcohol (75 p. c.). Dose, gr. 5–30 (.3–2 Gm.).

*Commercial*.—Plant mostly cultivated (since 1850) from cuttings (sometimes seeds) in Papantla, Misantla, Vera Cruz, and Oaxaca provinces, where moisture is abundant and temperature never below 18° C. (65° F.), climbs by rhizoids (non-absorbing roots), bears fruit the third year, and continues thereafter for thirty to forty; collect odorless fruit in late autumn before quite ripe, as green begins disappearing into yellow, to avoid splitting, then place in heaps, sheltered from sun and rain; after a few days, when somewhat shriveled by this partial fermentation, they are "sweated" by being exposed to the sun, or stove-heat (60° C.; 140° F.) until a fine chestnut-brown color is acquired, and the odorous principle (vanillin) has been developed from the normal coniferin (secreted by the internal hair-like fibrillæ), which is converted by hydrolization into glucose and coniferic alcohol, then this latter by an oxydase into vanillin; process may be aided by the sweating-box, steaming, wrapping in blankets, etc.; they are now dried by exposing to the sun for 2 months, then coated with oil (that which exudes, also cocoa and cashew nut), tied in small bundles of 50–75, wrapped in foil, and marketed; by insufficient drying, to retain weight, the interior beans, and wherever tied, sometimes become mouldy.

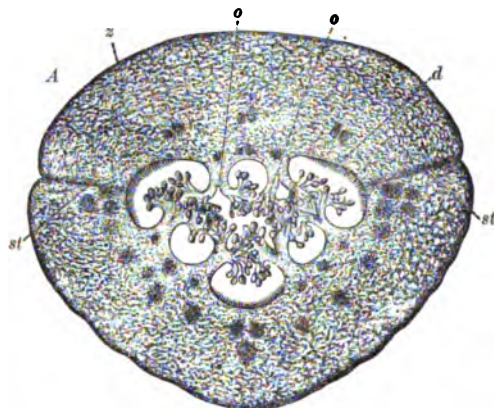
There are several varieties: 1. *Mexican*, *Vera Cruz*, the best, but beans vary much in value. 2. *Bourbon*, from Isle of Réunion, resembles Mexican, but beans blacker, tapering portion shorter, less firm, surface smooth, waxy, and soon becomes coated with acicular crystals (frost); odor more like Tonka bean. 3. *Mauritius*, inferior Bourbon, from the Seychelles, pods only 15 Cm. (6') long, 6 Mm. ( $\frac{1}{4}$ ') wide, pale color, smooth, not waxy, faint odor. 4. *Venezuelan* (*V. guianensis*), 10 Cm. (4') long, rather thick, Tonka odor. 5. *Brazilian* (*V. Pompona*) called *Vanillons*, larger, thicker than Venezuelan, inferior vanilla odor (heliotrope), contains 0.5 p. c. vanillin. Some beans also come from Java, Honduras, Madagascar, Tahiti, Guadeloupe, etc.;

FIG. 74.

*Vanilla planifolia.*

others occur on the market having had the vanillin removed by a solvent, and others still to which benzoic acid has been added. All may occur on the market as "splits" and "cuts."

FIG. 75.



Vanilla fruit, cross-section magnified: *z*, fruit flesh; *st*, opening suture; *o*, seed placenta; *d*, papillae.

**CONSTITUENTS.**—Vanillin (Mexican 1.7 p. c., Bourbon 2 p. c., Java 2.75 p. c., in the 2 last associated with odorous oil), fixed oil 11 p. c., resin, sugar, mucilage, ash 4–5 p. c.

**Vanillinum, Vanillin,  $C_8H_8O_3$ , official.**—(Syn., Fr. Vanilline; Ger. Vanillin.) This methylprotocatechuic aldehyde not only occurs naturally in vanilla, but may be made artificially from several orthodihydroxybenzene derivatives; from the former it is obtained by crushing pods with sand, extracting with ether in a Soxhlet tube, shaking out ethereal extract with sodium sulphite solution, liberating vanillin from this by treating with sulphuric acid, expelling sulphurous acid generated by carbon dioxide, extracting with ether. It is in fine, white, crystalline needles, odor and taste of vanilla, soluble in alcohol ether, glycerin, chloroform, 100 parts water, no residue; in damp air oxidizes slowly to vanillic acid,  $C_8H_8O_4$ ; combines with bases, heated to  $200^\circ C.$  ( $392^\circ F.$ ) with diluted hydrochloric acid forms methyl chloride and protocatechuic acid. *Tests*: 1. Soluble in alkali hydroxide solutions, from which precipitated by acids. 2. With ferric chloride T. S. gives blue color, changing to brown by boiling. 3. Warm 0.1 Gm. with concentrated alcoholic solution sodium hydroxide, add chloroform, warm, should not get odor of phenyl-isocyanide (abs. of acetanilide). It is made artificially by oxidizing with sulphuric acid and potassium dichromate the glucoside coniferin,  $C_{16}H_{22}O_8 + H_2O$  (found in the cambium of pines); also prepared by treating eugenol with alcoholic potassium hydroxide to form isoeugenol, which by further oxidation yields vanillin; has likewise been made from phenol (carbolic acid) and from guaiacol by heating with sodium hydroxide and chloroform. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{3}$  (.01–.02 Gm.).

**PIPERACEÆ.**

**PREPARATIONS.**—1. *Tinctura Vanillæ*. Tincture of Vanilla. (Syn., Fr. Teinture de Vanille; Ger. Vanillatinktur.)

*Manufacture*: 10 p. c. Macerate 12 hours 10 Gm. in 50 Cc. alcohol 65 p. c., drain, set aside liquid; beat in mortar the vanilla + sugar 20 Gm. to uniform powder, percolate with reserved liquid, finishing with alcohol 65 p. c., q. s. 100 Cc. For flavoring.

*Unoff. Preps.*: *Fluidextract*. *Syrup*. For flavoring.

**PROPERTIES.**—Carminative, stimulant, aphrodisiac, antihysterical, irritant. Those working in it have itching hands, face; skin covered with pruriginous eruptions, dizziness, weariness, muscular pains; eruptions due to an *acarus* which does not enter the skin.

**USES.**—The Spanish conquerors found vanilla in use in Mexico for flavoring chocolate, etc., and while now recommended for hysteria, it is chiefly employed as a flavoring agent, being the most general of all substances; large quantities sometimes produce poisonous symptoms.

*Allied Plants*:

1. *Vanilla Pompo'na*, Guadeloupe variety, *V. Gardne'ri*, Brazilian and Bahia, *V. odora'ta*, *V. phæan'tha*, Jamaica, Trinidad.

2. *Or'chis mas'cula* and other species, *Salep*. The fecula of the root, official 1820–1830. C. and S. Europe; rich woods. Small herb 15–45 Cm. (6–18') high, leaves parallel-veined, sheathing; flowers pinkish, showy, nectariferous spur underneath; root (tubers) consists of 2 fleshy tubers 2.5 Cm. (1') long, deprived of epidermis by scalding in water; yellowish-brown, hard, translucent, horny, insipid; contains starch 27 p. c., mucilage 48 p. c. Starch obtained by grinding root under water, straining, subsiding. Used as demulcent, nutritive diet for infants, children, chronic diarrhœa, cholera infantum, tuberculous diarrhœa, in mucilage (1 part + water 50). *Adulterations.*—**TUBERS**: Colchicum corm, this latter being recognized by its side groove and sweet, bitter, acrid taste; **POWDER**: Starch, flour, which can readily be distinguished by microscope. Dose, *ad libitum*.

**SUB-CLASS 2: DICOTYLEDONES** (Embryo with 2 cotyledons, stem exogenous (with pith, wood, bark), leaves net-veined).

**SERIES 1: CHORIPETALÆ.** Petals separate and distinct, or wanting.

**15. PIPERACEÆ. Pepper Family.**

**Pip-e-ra'se-e.** L. *Piper* + *acæ*, Gr. *πίπερι*, Skt. *pipala*, Bengalese *pippul*, fr. Gr. *πέπω*, to digest—i. e., it aids digestion. Herbs or shrubs. Distinguished by jointed stems; leaves entire; flowers

FIG. 76.



*Orchis mascula.*



perfect, without floral envelopes, spikes; ovary 3–5, somewhat united, 1-celled; ovule 1, stigma 2–4; fruit somewhat fleshy, 1-celled, 1-seeded; tropics; acrid, pungent, aromatic, stimulant (volatile oil + resin).

Genera: 1. *Piper*.

## CUBEBA. CUBEB.

*Piper Cubeba*, *Linné filius*. } The dried, unripe, but fully  
(*Cubeba Cubeba*, (*Linné filius*) *Lyons*.) } grown fruit.

*Habitat.* Java, Sumatra, Borneo; cultivated in two former islands, and in W. Indies, Ceylon.

*Syn.* Tailed Cubebs, Tailed Pepper, Java Pepper, Cubebs; Br. *Cubebæ Fructus* (*Baccæ*), *Piper Caudatum*; Fr. *Cubèbe*, *Poivre à Queue*; Ger. *Kubeben*.

*Pi'per.* L. see etymology, page 139, of *Piperaceæ*.

*Cu-be'ba.* L. fr. Gr. *κονβέβα*, of *Actuarius*; name used since the tenth century. Pers. *kababa*, their native name of the plant.

**PLANT.**—Climbing woody perennial; stem jointed, flexuous, 6 M. (20°) high; leaves 15 Cm. (6') long, lanceolate, leathery, shining, nerved, petiolate, flowers dioecious, spikes. **FRUIT**, 10–13 Mm. ( $\frac{2}{5}$ – $\frac{1}{2}$ ') long, upper portion globoidal, 4–5 Mm. ( $\frac{1}{8}$ – $\frac{1}{6}$ ') thick, contracted at base into slender stem-like portion (stipe, not a true pedicel, but stigma remnants) 6–8 Mm. ( $\frac{1}{4}$ – $\frac{1}{3}$ ') long, pericarp reticulately wrinkled, blackish-gray, 0.3 Mm. ( $\frac{1}{30}$ ') thick; mesocarp with many oil cells; internally light brown, smooth, 1-seeded, brittle; odor strong, aromatic, somewhat camphoraceous; taste pungent, bitter; powder contains few or no starch grains, and when treated with sulphuric acid fragments become wine-colored. *Solvents*: ether; alcohol. *Dose*, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—Cubeb rachis or stalks (inodorous, increasing fibrovascular tissue and ash), black pepper and other piperaceous fruits (*P. caninum*, *P. cras'sipes*, *P. Lo'wong*, *P. mollis'simum*, *P. ribesoides*, *P. Chu'sii*, *Sit'sea citra'ta*, etc.), all distinguished by characteristic shape, odor, and taste. *Rhamnus cathartica* fruit (pedicellate and contains 4 seeds), allspice (much larger, 2-seeded, no pedicel). *Juniper communis* fruit (much larger, different taste). Powdered cubeb deteriorates unless kept in tight containers, hence best to powder only when needed, sometimes mixed with powdered allspice, flour, or starch.

**Commercial.**—Cubeb grows extensively in coffee plantations or on grounds reserved for the purpose, being supported usually on shade trees; fruit is gathered when full-grown, but before ripe; dried carefully in the sun, and exported from Java to Singapore, whence it enters market.

**CONSTITUENTS.**—Volatile oil 5–15 p. c., Resin 2.5–3.5 p. c., Cubebin 0.4–3 p. c., Cubebic acid 1–3.5 p. c., fatty oil 1 p. c., gum 8 p. c., starch, ash 5–6 p. c.

**Oleum Cubebæ.** Oil of Cubeb, *official*.—(*Syn.*, *Oleum Cubebæ*, *Oil of Cubebs*; Fr. *Essence de Cubèbe*; Ger. *Kubebenöl*.)

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This volatile oil, obtained from cubeb by distilling with water or steam, is a yellowish-green liquid, characteristic odor of cubeb, warm,

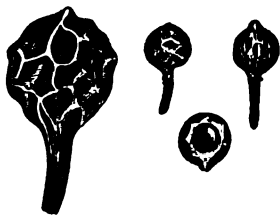
FIG. 77.

*Piper Cubeba.*

camphoraceous, aromatic taste, sp. gr. 0.920, soluble in equal volume of alcohol; contains a little dipentene,  $C_{10}H_{16}$ , but mostly sesquiterpene, cadinene,  $C_{15}H_{24}$ . If old, or distilled from old fruit, it then has additionally an inodorous stearopten, cubeb camphor,  $C_{15}H_{24} \cdot H_2O$ , which soon deposits. *Tests*: 1. With sulphuric acid turns yellow; when warmed, red; dissolves iodine quietly. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathcal{M}v-20$  (3.—1.3 Cc.).

**Resin.**—Extracted by ether, which also takes up volatile oil, fixed oil, cubebin, chlorophyll, and wax; evaporate off volatile oil, when cold cubebin and wax deposit; decant from these, separate fat and have left the resin, which is amorphous, soluble in alkalies, alcohol, not precipitated by alcoholic solution of lead acetate.

FIG. 78.



Cubeb: fruit, natural size, and magnified.

**Cubebin**,  $C_{10}H_{10}O_3$ .—This constitutes the precipitate from oleoresin upon standing; it is white, crystalline, inodorous, inert; alcoholic solution bitter.

**Cubebic Acid**,  $C_{14}H_{16}O_4$ .—Brownish, resin-like mass, soluble in alkalies, alcohol, ether, chloroform, precipitated by lead acetate; diuretic. Dose, gr. 5–10 (.3–.6 Gm.). Last three are red with sulphuric acid.

**PREPARATIONS**.—1. *Fluidextractum Cubebæ*. Fluidextract of Cubeb. (Syn., Extractum Cubebæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Cubèbe; Ger. Flüssiges Kubeben(Cubeben)-extrakt.).

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose, ℥xv–60 (1–4 Cc.).

2. *Oleoresina Cubebæ*. Oleoresin of Cubeb. (Syn., Extractum Cubebæ Æthereum; Fr. Oléorésine de Cubèbe; Ger. Extractum Cubebarum (Ætherisches), Kubebenextrakt.)

*Manufacture*: Percolate 100 Gm. with alcohol until exhausted, recover alcohol by distillation on water-bath; after standing deposits wax and cubebin, which are removed by decantation and rejected; the remaining liquid contains fixed and volatile oils, resins, chlorophyll; yield 18–25 p. c. Should be kept in well-stoppered bottles. Dose, ℥v–30 (.3–2 Cc.).

Prep. 1. *Trochisci Cubebæ*. Troches of Cubeb. (Syn., Fr. Pastilles de Cubèbe; Ger. Kubebenpastillen.)

*Manufacture*: Oleoresin of cubeb 2 Gm., oil of sassafras 1 Cc., extract of glycyrrhiza 25 Gm., acacia 12, syrup of tolu q. s. 100 troches. Dose, 1–5 troches.

*Unoff. Preps.*: *Tincture*, 20 p. c., (alcohol), dose, ʒss–2 (2–8 Cc.). *Extract*, dose, gr. 2–10 (.13–.6 Gm.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.).

**PROPERTIES**.—Diuretic (resin + cubebic acid), stimulant, carminative, expectorant, disinfectant, local irritant (volatile oil), may cause headache, giddiness, nausea, purging, paralysis; it is eliminated by bronchial mucous membrane, skin, and kidneys, all being stimulated and the increased secretions disinfected; imparts to urine a peculiar odor.

**USES**.—Gonorrhœa, urethritis, vesical irritability, cystitis, abscess of prostate gland, piles, chronic bronchitis, catarrh. Arabians used it similarly to black pepper, and were the first to introduce it into Europe.

#### *Allied Plants:*

1. *Piper Lo'wong* (*Cubeba Lowong*) and *P. ribesoides* (*C. Wallich'ii*), fruit of both much like the official.

2. *P. caninum* (*C. canina*), fruit smaller than official, contracted below into a stalk half the length of the globular portion, and *P. crassipes* (*C. crassipes*), fruit larger than the official.

3. *False Cubebs*.—Origin unknown, fruit wrinkled, brownish-gray, size of the official, stalk 5 Mm. ( $\frac{1}{8}$ ') long, odor mace-like.

PIPERACEÆ.

PIPER. PEPPER.

**Piper**  
**nigrum**, Linné. } The dried unripe fruit.

*Habitat.* S. India, Malabar Coast, Philippine Islands, Sumatra, Java, Singapore, Ceylon, Penang, Luzon, Borneo, Malacca, Siam, W. Indies.

*Syn.* Black Pepper, Pepper Corn, Pepper Vine, African Black Pepper, Cubeb Pepper; Br. Piper Nigrum; Fr. Poivre noir (commun); Ger. Schwarzer Pfeffer.

**Nigrum.** L. *niger*, black, fr. *nec*, to die, as seen in Gr. *νεκρός*, dead, *nox*, night—i. e., color of the brownish-black fruit when compared with other varieties.

**PLANT.**—Perennial trailing or climbing vine; stem 6–9 M. (20–30°) long, articulated, smooth, woody, joints thickened, from which adventitious rootlets arise for adhering to support or taking root in the soil; leaves 10–15 Cm. (4–6') long, ovate, petioles 12 Mm. ( $\frac{1}{2}$ ') long, acute at base and apex, entire, smooth, leathery, dark green, 5–7-nerved, flowers whitish, unisexual, sessile, elongated spikes. **FRUIT**, berry-like, sessile, green, then red, when ripe yellow, nearly globular, 4–5 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') thick, brownish- or grayish-black, pericarp thin, coarsely wrinkled, enclosing a single whitish, more or less imperfect seed; odor strong, penetrating, sternutatory; taste aromatic, very pungent; starch grains in powder nearly spherical. *Solvents*: ether, alcohol; water partially. Dose, gr. 5–20 (.3–1.3 Gm.).

**ADULTERATIONS.**—**FRUIT**: Fruits of allied species, stalks, chaff, siftings; **POWDER**: Starches, mustard, husks, flaxseed, capsicum, all recognized by microscope; pepper shells removed in layers, giving "first grinding," etc., the outer being successively weaker; sand, aniline, thalline, naphthylamine, shells of walnuts, almonds, cocoanuts, olive stones. Rice starch and the starch in pepper have same shape, but quantity present will aid detection.

**Commercial.**—Our supply comes from Singapore, Sumatra, and Java, where plants are propagated by cuttings which are planted at the roots of trees, chiefly Betel, and trained to run thereupon as a support, thus allowing the land to yield two products. When the basal fruits begin changing from green to red the whole spike is gathered; if allowed to remain on until ripe they are eaten by birds, fall to the ground, and are less pungent. Vines yield 8–10 pounds (3.5–4.5 Kg.) annually, begin bearing when 2–4 years old, and decline after fifteenth year. The day after gathering the spikes are deprived of fruit, which is cleaned of

FIG. 79.



*Piper nigrum.*

stalks by picking, rubbing, etc., and dried at once by sun or fire, or after a slight boiling. There are several varieties or grades usually recognized by relative weight: (a) *Heavy*. 1. *Malabar*, via Tellicherry, heaviest. 2. *Penang*, strongest. 3. *Singapore*, darkest. 4. *Straits Settlements*, principal and best product; (b) *Light*. 5. *Cochin*. 6. *Siam*. These are often mixed in England, taking Malabar for weight, Penang for strength, Sumatra for color.

**CONSTITUENTS.**—Piperine 5–8 p. c., Piperidine 0.56 p. c., Volatile oil 1–2 p. c., Chavacin, Piperic acid, starch 30–40 p. c., fat 7 p. c., proteids 12 p. c., ash 4.5–6.5 p. c.

**Piperina.** Piperine,  $C_{17}H_{19}NO_3$ , *official*.—This feebly basic substance is obtained from pepper and other Piperaceæ plants by treating alcoholic extract with potassium hydroxide solution, which dissolves resin and forms soap of fat; wash residue with water, filter, treat residue on filter, repeatedly with alcohol, from which piperine crystallizes. It is in pale yellowish, glistening, monoclinic crystals, odorless, at first tasteless, afterwards sharp, biting, permanent, no residue, soluble in 15 parts alcohol, 36 ether, 1.7 chloroform; imparts most, if not all the pungency. *Tests*: 1. Sulphuric acid dissolves it, giving blood-red color, disappearing on dilution with water. 2. Heating with alcoholic potassium hydroxide converts it into piperinic (piperic) acid,  $C_{12}H_{10}O_4$ , and piperidine, the latter recognized by its alkaline, pepper-like odor, the former by its melting-point,  $215^{\circ}C.$  ( $419^{\circ}F.$ ). 3. Sulphuric acid + fragment potassium dichromate gives purple color, which on stirring dissolves, forming reddish-brown solution, turning greenish with water. 4. Heated with nitric acid get orange, red, the acid acquiring yellow color, deepening to reddish as crystal dissolves; excess potassium hydroxide T. S. gives yellow, which boiled becomes blood-red. Dose, febrifuge, gr. 1–5 (.06–.3 Gm.).

**Piperidine**,  $C_5H_{11}N$ .—Obtained by dry distillation of piperine with soda-lime; it is a colorless liquid alkaloid, ammoniacal, peppery odor, when largely diluted bitter, soluble in water, alcohol, readily forms with acids crystallizable salts (hydrochloride, etc.).

**Volatile Oil**,  $C_{10}H_{16}$ .—Obtained by distillation with water or steam; it is nearly colorless, sp. gr. 0.880, imparts the odor but not pungency, soluble in 15 parts alcohol; contains dipentene, phellandrene, terpene. The commercial oil of *black pepper* (*Oleum Piperis*) is the volatile oil, fixed oil, and pungent resin, being a by-product in making piperine, consequently is very similar to the oleoresin. Dose,  $\mathfrak{m}\text{j}$ –3 (.06–.2 Cc.).

**Chavacin**.—Obtained by neutralizing the potassium hydroxide solution (for piperine) with an acid; it is a soft pungent resin, whose pungency depends upon the presence of piperine and piperidine; soluble in alkalies, alcohol, ether.

**PREPARATIONS.**—1. *Oleoresina Piperis*. Oleoresin of Pepper. (Syn., Extractum Piperis Fluidum. Fluidextract of Black Pepper. Fr. Oléorésine de Poivre noir; Ger. Ätherisches Pfefferextrakt.)

*Manufacture*: Percolate 100 Gm. with acetone until exhausted, recover acetone by distillation on water-bath, when from residue crys-

## PIPERACEÆ.

tals of piperine have ceased to deposit, strain oleoresin therefrom through purified cotton; contains fixed and volatile oils holding in solution pungent resin and some piperine, the latter precipitating upon standing, when it should be rejected; yield 5–6.5 p. c. Should be kept in well-stoppered bottles. Dose, Mss—2 (.03–.13 Cc.).

*Unoff. Preps.*: *Fluidextract*, dose, Mv—20 (.3–1.3 Cc.). *Plaster* (oleoresin 1 gr. (.06 Gm.) to every 4 square inches + resin plaster q. s.). *Confectio Piperis* (Br.), 10 p. c., dose, ʒj—2 (4–8 Gm.). *Poultice*.

**PROPERTIES.**—Stimulant, tonic, febrifuge, irritant, rubefacient, carminative, antipyretic. Stimulates secretion of mouth, stomach, kidneys; excessive doses give abdominal heat, thirst, vomiting, fever, convulsions, increases urine, irritates bladder, urethra, and may cause urticaria.

**USES.**—Intermittents, enlarged lymphatic glands, gargles to stimulate throat, gums, plasters for muscular rheumatism, headache, colic, also for flatulence, indigestion, head-lice, gleet, leucorrhœa, gonorrhœa, fistula, paralysis of tongue. From Hippocrates' time down as a condiment, and as such to-day ranks next to salt the world over.

*Allied Plants:*

1. *Piper officinarum* (*lon'gum*), *Long Pepper*.—The immature fruit dried in the sun, official 1830–1840. Java, India, Ceylon, Philippine Islands, Bengal. Shrub like official; leaves cordate; flowers spikes; fruit spike-like cone 2.5–4 Cm. (1–1½') long, 5 Mm. (¼') thick, cylindrical, uneven, dusty, blackish-gray, the many coalesced fruits spirally arranged, each crowned with style remnant; odor, taste, properties, and composition like official. The Bengal long pepper is darker and shorter (2.5 Cm.; 1' long) than that from elsewhere.

2. *P. al'bum*, *White Pepper*.—From unripe fruits of *P. nigrum*, by gathering spike when fruits fully matured, cleaning same, immersing in water, and depriving of epicarp and sarcocarp by rubbing with the hands in baskets; are somewhat larger than official, smooth, yellowish, hard, horny, mealy within; taste and odor similar to but less powerful than the black. Have four varieties: 1. Tellicherry. 2. Penang. 3. Batavia. 4. Singapore. Much used in China. A spurious variety is made by soaking off (or using mechanical means) the outer portion of black pepper (pericarp), or simply drying the very young and immature fruits; this is smaller and inferior.

## MATICO. MATICO.

**Piper**  
**angustifolium**, Ruiz et Pavon. } The leaves.

*Habitat.* Tropical America, Peru, Mexico, Venezuela, Brazil, Cuba. Cultivated.

*Syn.* West Indian Matico, Pepper Elder, Soldier's Herb; *Maticæ Folia*; Fr. Feuilles de Matico; Ger. Maticoblätter.

**An-gus-ti-fo-li-um.** *L. angustus*, narrow, + *folium*, a leaf; i. e., has narrow leaves.

**Ma-ti'co.** A Spanish soldier named Matico, being wounded, dragged himself toward some of these green plants, which, when applied, stopped the bleeding; also called, in Spanish, *yerba soldado* or *palo-del-soldado*, soldier's herb or tree.

**PLANT.**—Shrub with stem 3 M. (10°) high, having enlarged joints and branches quadrangular, younger ones hairy; flowers minute, yel-

lowish, dense, on slender spike, 10–17.5 Cm. (4–7') long; fruit size of poppy seed, hard, black, 1-seeded. LEAVES, 10–15 Cm. (4–6') long, petiolate, oblong-lanceolate, apex pointed, base unequally heart-shaped, crenulate, tessellated above, reticulate beneath, meshes small, veins

FIG. 80.



Matico: natural size.

densely brownish-hairy; aromatic, spicy, bitterish, astringent. *Solvents*: boiling water; alcohol (50–75 p. c.). Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—Leaves of allied species and other S. American plants which are also called matico, as *Eupatorium glutinosum*, *Waltheria glomerata*, *Piper lanceafolia*, and *P. aduncum*. All these have matico properties, but none are tessellated above or rough and hairy below.

**CONSTITUENTS.**—Volatile oil 2–3 p. c. (contains matico-camphor,  $C_{12}H_{20}O$ ), artanthic acid (crystalline), pungent resin, bitter principle, tannin, mucilage. The name maticin was given to a supposed bitter principle, which now proves to be only a potassium salt.

**PREPARATIONS.**—1. *Fluidextractum Matico*. Fluidextract of Matico. (Syn., *Extractum Matico Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Matico*; Ger. *Flüssiges Maticoextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose, Mxv–60 (1–4 Cc.).

*Unoff. Preps.*: *Tincture*, 10 p. c., dose, ʒj–2 (4–8 Cc.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.).

**PROPERTIES.**—Mostly due to the volatile oil; stimulant, tonic, styptic, vulnerary, diuretic, aphrodisiac, constricts capillaries, hence controls mucous fluxes, hemorrhages, resembles cubeb.

**USES.**—Bronchitis, gonorrhœa, menorrhagia, hemorrhoids, diarrhœa, dysentery, hæmaturia, hemorrhage, vesical catarrh, incontinence of urine; locally leaves to bleeding surfaces, owing to the many hairs promoting blood-clot.

#### *Allied Plants*:

1. *Piper Be'tle*.—India. Climbing plant; leaves chewed by Malays with lime and areca-nut shavings. *P. Carpun'ya*, Chile, Peru. Small tree. *P. pelta'tum*, *P. umbella'tum*. Tropical America. Diuretic, skin diseases, tumors.

2. *Methys'ticum Methysticum* (*Piper Methysticum*), *Ava* (*Kava-Kava*).—Sandwich Islands. The root of this is used as a stimulant, diuretic, diaphoretic, tonic, has lilac odor, pungent, bitter taste; contains acrid resin 2 p. c., volatile oil, kavahin, methysticin (resembles piperine); its infusion yields upon fermentation the beverage *kava*; also used natively for gonorrhœa, vesical and urethral affections.

## PIPERACEÆ.

3. *Ju'glans cine'rea*, *Butternut*.—Juglandaceæ. The root-bark, collected in autumn, official 1820–1900; N. America (Canada, United States). Handsome tree, 9–15 M. (30–50°) high, branched, deliquescent; leaves imparipinnate, 5–9 pairs of leaflets; flowers—staminate and pistillate; fruit large drupe, oblong, 6 Cm. (2½') long, hairy, viscid, green then brown; seed or kernel thick, oily, edible. Root-bark (liber), in pieces, 5 Mm. (½') thick, deprived of soft cork, deep brown, smoothish, striate, transverse fracture short, delicately checkered; this inner bark when first uncovered is pure white, but upon exposure immediately becomes lemon color, finally deep brown; contains nucin (juglone, juglandic acid), fixed oil 14 p. c., volatile oil, resin, tannin. Resembles rhubarb, but does not gripe—cathartic, tonic, rubefacient; costiveness, dysentery, with calomel in intermittent and remittent fevers. Dose, ʒj–2 (4–8 Gm.); extract (alcohol), gr. 5–20 (.3–1.3 Gm.); juglandin ("Eclectic" resinoid), gr. 3–10 (.2–.6 Gm.).



FIG. 81.  
Juglans: flowering branch;  
cross-section of fruit.

4. *J. re'gia*, *English Walnut*.—Persia, Himalayas, China, cultivated, Europe. Decoction of leaves used in leucorrhœa, meningitis; decoction of leaves, rind, or bark in checking mammary secretion, ulcers, diarrhœa, sore mouth, tonsils, uterine hemorrhages, carbuncles.

5. *J. ni'gra*, *Black Walnut*.—Bark styptic, acid; used mostly in dyeing. The rind of green fruit removes ringworms, tetter, diphtheria. Decoction used as a vermifuge. Spirit made by distilling fresh walnuts with alcohol; used in hysteric, cerebral, and pregnant vomiting. All of these fruits contain much fixed oil, which turns red with nitric acid, but brown with nitric and sulphuric acids.

## 16. SALICACEÆ. Willow Family.

Sal-i-ka'se-e. *L. Sali(x)c* + *aceæ*, willow, from Celtic *sal*, near, + *lis*, water—*i. e.*, its favored place of growth; or *L. salire*, to leap—its rapid growing. Trees or shrubs. Distinguished by light wood, bitter bark, alternate, stipulate leaves, diœcious flowers, both kinds in catkins, 1 to each bract, no perianth; fruit 1-celled, 2–4-valved pod, many-seeded, each with long silky hairs at one end, but covering it; ovary 1-celled, superior; stamens 2 or more; temperate climates; tonic, astringent, febrifuge, stimulant; timber, basket-making, seed hair for cushions.

Genera: 1. *Salix*. 2. *Populus*.



## SALIX. SALIX (WILLOW).

**Salicinum.** Salicin,  $C_{13}H_{18}O_7$ , *official*.**Salix and Populus** } A glucoside.  
several species.*Habitat.* Europe, N. America; cultivated.*Syn.* White, Duck, Common European, or Salicin Willow, Withe, Withy; Fr. Saule blanc, Salicine; Ger. Weidenrinde, Salicin.**Salix.** L. see etymology, page 147, of Salicaceæ.**Populus.** L. poplar, fr. *populus*, the people, being often planted along the public ways in Rome, where it was called *arbor populi*, tree of the people.

**PLANTS.**—These two juxta-positioned genera are composed mostly of large trees 15–18 M. (50–60°) high, with flexible branches; *Salix* leaves, long pointed, entire or glandularly toothed. *Populus* leaves, broad, more or less heart-shaped, ovate, toothed; flowers May, both in catkins appearing before the leaves, diœcious, buds covered with scales, or a varnish; barks of both genera resemble; that of *Salix* slips from the wood more readily.

**CONSTITUENTS.**—Salicin 1–3 p. c., tannin 12 p. c., extractive matter.

**Salicinum. Salicin.**—Obtained by several methods: 1. Add litharge or basic lead acetate to hot concentrated decoction of young bark to remove tannin, gum, extractive; the filtrate contains salicin and some absorbed lead, the latter is separated by adding sulphuric acid and barium sulphide, while salicin, upon concentration of the filtrate, crystallizes out. When basic lead acetate is used, the free acid should be neutralized with calcium carbonate, and then the filtrate evaporated. 2. Boil bark with milk of lime to remove tannin, evaporate filtrate to soft extract, digest this with alcohol, from which salicin will crystallize after distilling off alcohol. Occurs in white, silky crystalline needles

FIG. 82.



Willow bark: transverse section, magnified 15 diam.

or powder; odorless, bitter, insoluble in ether, chloroform; soluble in 21 parts water, 71 alcohol, no residue; by diluted acids splits into sugar and saligenin,  $C_7H_8O_3$ , the latter on further boiling becoming saliretin,  $C_{14}H_{14}O_3$ , a resinous body. *Tests:* 1. A little heated in test-tube until brown, + a few Cc. water + a drop ferric chloride T. S. gives violet color. 2. With sulphuric acid get red color, disappearing upon adding water. 3. Heat 0.1 Gm. with 0.2 Gm. potassium dichromate + 2 Cc. diluted sulphuric acid gives odor of salicylic aldehyde (or of oil of meadow-sweet, *Ulmæria* (*Spiræa*) *Ulmæria*). 4. Aqueous solution is not precipitated by tannic or picric acid T. S. or mercuric potassium iodide T. S. (abs. of and dif. from alkaloids). Dose, gr. 10–30 (.6–2 Gm.).

The *White Willow* (*Salix alba*) and *Crack Willow* (*S. fragilis*) con-

**BETULACEÆ.**

tain most tannin, the *Purple Willow* (*S. purpurea*) most salicin, it being even in the leaves, although largest quantity in bark of young wood. *Populus alba*, *P. angustifolia*, *P. acuminata*, *P. tremula*, all yield salicin to a considerable extent.

**PREPARATIONS.**—(Unoff.) May give in powder, pill, syrup, water, or with licorice extract, in small and frequent doses.

**PROPERTIES.**—Bitter tonic, antiperiodic, antipyretic, antiseptic, antiferment. Its action is slower, weaker, and depresses heart less than salicylic acid; it is non-toxic, possibly circulates like salicylic acid in the blood as sodium salicylate, and is eliminated chiefly by the urine as salicylic, salicyluric, salicylous acids and saligenin, being first converted in the stomach into glucose and saligenin.

**USES.**—Acute rheumatism, lower temperature in fevers; relieves pain, reduces arterial swellings, intermittents (not nearly so effective as quinine), coryza, hay fever, influenza, neuralgia, diabetes. Externally—gangrenous wounds, eczema, cancer, burns, fetid perspiration (applied in solution with borax).

**17. BETULACEÆ. Birch Family.**

Bet-u-la'se-e. L. *Betul-a* + *aceæ*, fr. Celtic *betu*, the birch—i. e., its original name. Trees or shrubs. Distinguished by having astringent resinous bark; flowers monœcious, aments, staminate in the axil of each bract, stamens 2–10, calyx 2–4-parted, pistillate, pendulous, calyx none—instead have scaly bracts. Differs from allied *Fagaceæ* (*Cupulifere*) by superior ovary and absence of cupule, even yet by some included in that family; ovary 2-celled, ovules 1 in each cell; temperate climates; astringent, saccharine, timber, paper, charcoal.

Genus : 1. *Betula*.

**BETULA. BIRCH.**

*Oleum Betulæ.* Oil of *Betula*, *official*.

*Betula*  
*lenta*, Linné. } A volatile oil distilled from the bark.

*Habitat.* N. America (Newfoundland to Georgia, Minnesota, Indiana): forests.

*Sim.* Black-, Cherry-, Mahogany-, Sweet- or Spice Birch, Mountain Mahogany. *Oleum Betulæ Volatile*, U. S. P. 1890, Oil of Sweet Birch; Fr. *Essence de Betula*; Ger. *Birch-rindenöl*.

*Bet'u-la.* L. see etymology, above, of *Betulaceæ*.

*Len'ta.* L. *lentus*, soft, pliant, flexible—i. e., its stems and branches.

**PLANT.**—Tree, 12–24 M. (40–80°) high, .6–1 M. (2–3°) thick; bark dark brown, close, smooth, sweet, aromatic; leaves 7.5–10 Cm. (3–4') long, 2.5–5 Cc. (1–2') wide, ovate, acuminate, serrate, petiolate; flowers, staminate catkins, 5–7.5 Cm. (2–3') long; pistillate ones much shorter, thicker. The bark is not separable into layers, but the cambium, when wounded in the spring, exudes sweet, acid, edible juice; wood reddish, strong, compact.

CONSTITUENTS.—Volatile oil, gaultherin, tannin 3.3 p. c., betulin (camphoraceous).

**Oleum Betulæ.** Oil of *Betula*.—This does not preëxist in the dried bark, but is formed by the action of water and an unknown compound upon the neutral principle, gaultherin, a substance analogous to amygdalin; the oil is obtained from the bark by macerating about 12 hours, thereby causing hydrolysis of the glucoside gaultherin into methyl salicylate and a sugar, then distilling; it is nearly identical with methyl salicylate,  $\text{CH}_3\text{C}_7\text{H}_5\text{O}_3$ , as well as the oil of gaultheria—this latter having in addition the alcohol,  $\text{C}_8\text{H}_{16}\text{O}$ ; contains methyl salicylate 99.8 p. c., paraffin triacontan,  $\text{C}_{30}\text{H}_{62}$ , an aldehyde or ketone, and the ester,  $\text{C}_{14}\text{H}_{24}\text{O}_2$ ; it is optically inactive, otherwise properties, reactions, tests, sp. gr. 1.180, correspond with those of methyl salicylate and oil of gaultheria, for which it is generally recognized and sold. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{M 1-10}$  (.06–.6 Cc.).

ADULTERATIONS.—Artificial methyl salicylate, alcohol, phenols, oil of turpentine, petroleum, etc.

USES.—Rheumatism, gout, scrofula, cutaneous eruptions, bladder affections, scurvy, intermittent fever.

*Allied Plants:*

1. *Betula alba*.—Asia, Europe, N. America (Can. to Penn.). The buds and twigs yield by distillation .33 p. c. colorless volatile oil; the wood and bark (in layers) yield brown birch tar, having odor of Russia leather. When this tar is distilled we get *Empyreumatic Oil of Birch* (*Oleum Rusci*).

2. *B. papyrifera*, *Paper* or *Canoe Birch* (*White Birch*).—Canada, New York. This has cordate leaves, tough white bark, splitting into papery layers. Used by the Indians in making canoes.

# 18. FAGACEÆ (CUPULIFERÆ). Beech Family.

Fa-ga'se-e. L. *Fag-us* + *aceæ*, fr. Gr. φαγεῖν, to eat, φαγό-, the beech—i. e., in allusion to the esculent nuts once used as food. Trees or shrubs. Distinguished by alternate irregular leaves; fruit in a bur or cupule—pistillate involucre; flowers monœcious, staminate, aments, stamens 5–20, pistillate, spikes 1–3, or scaly catkins, involucre; petals none; ovary inferior, 2–6-celled, ovules 1–2 in each cell; fruit 1-seeded nut; temperate climates, tropics; astringent, seed edible, valuable timber.

Genus: 1. *Quercus*.

## QUERCUS. WHITE OAK.

*Quercus alba*, Linné. } The dried bark, collected from trunks or branches 10–25 years of age, deprived of periderm.

*Habitat.* N. America (Canada to Florida, west to Minnesota, Texas, etc.).

*Syn.* *Quercus Alba*, U. S. P. 1890, Stone Oak, Tanners' Bark; Fr. Écorce de Chêne; Ger. Cortex Quercus, Eichenrinde.

*Quercus*. L. oak, fr. Celtic *quer*, fine, + *cuez*, a tree—fine, stately tree; or fr. Gr. χοῖρος, a pig—i. e., pigs love and feed on the acorns.

*Alba*. L. *albus*, white—i. e., owing to its wood and bark being so light in color.

**FAGACEÆ.**

**PLANT.**—Stately tree 18–24 M. (60–80°) high, 1–2.5 M. (3–8°) thick, branches many, spreading; leaves 7.5–15 Cm. (3–6') long, petioles 12–25 Mm. ( $\frac{1}{2}$ –1') long, oval, tapering at base, more or less

FIG. 83.



*Quercus alba*: a, staminate catkins; b, magnified staminate flower; c, pistillate flower with stigmas magnified; d, acorn in embryo; e, section of young acorn; f, cotyledon with radicle.

deeply pinnatifid, lobes 4–6, rounded, entire, smooth, light green above, glaucous with prominent veins beneath, when dry brownish, some remaining on tree all winter; flowers May, monœcious. Staminate in catkins 2.5–7.5 Cm. (1–3') long; pistillate single or in groups, followed by 1-seeded nut (acorn) enclosed at base in a cup, cupule, formed by scaly indurated involucre; fruit 25 Mm. (1') long, 12 Mm. ( $\frac{1}{2}$ ') broad, ovoid. BARK, in nearly flat pieces, 2–10 Mm. ( $\frac{1}{12}$ – $\frac{2}{3}$ ') thick, light brown, darker with age, rough-fibrous, fracture uneven, coarsely fibrous; odor distinct; taste strongly astringent; does not tinge saliva yellow when chewed. *Solvents*: alcohol; water. Dose, gr. 15–60 (1–4 Gm.).

**Commercial.**—White oak prefers slightly moist ground. It is almost identical with the European *Q. Robur* (L. *robur*, strong, hard—i. e., its wood), having in common with it variability in length of leaf-petioles and acorn stalks as well as depth of leaf-lobes: was first brought to England 1724. The bark is collected in spring, when it is most astringent, the outer layer discarded, the inner dried—that from young stems and small branches being preferred.

**CONSTITUENTS.**—Tannin 6–11 p. c., Oak-red, Quercin, resin, pectin, wax, fat, quercite.

**Tannin (Querci-tannic Acid).**—Obtained by acetone or washed

ether (+  $\frac{1}{16}$  vol. water), and is not identical with gallo-tannic acid, as it gives olive-brown with ferric salts, pinkish-red with lime water, and is not convertible into gallic or pyrogallic acid; consists of 2 forms, one soluble in water ( $C_{28}H_{28}O_{14}$ ), the other difficultly soluble ( $C_{28}H_{24}O_{12}$ ). It is yellowish-brown, amorphous, precipitates with lead acetate, gelatin, albumin, tartar emetic, alkaloids. The young bark contains most, and although it yields sugar with diluted sulphuric acid, some claim it not to be a glucoside.

**Oak-red**,  $C_{28}H_{22}O_{11}$ .—Obtained by heating with dilute acids, under pressure, querci- (querco-) tannic acid, thereby removing  $H_2O$ ; it is reddish-brown.

**Quercin**.—Bitter principle, obtained by boiling bark in acidulated ( $H_2SO_4$ ) water, adding milk of lime to neutralize; filter, add solution of potassium carbonate, dissolve precipitate in alcohol, evaporate, when yellow needles slowly form. Some say this is only quercite (oak-sugar),  $C_6H_{12}O_5$ .

**PREPARATIONS**.—1. *Fluidextractum Quercus*. Fluidextract of Quercus. (Syn., Fluidextract of White Oak; Fr. Extrait liquide d'Écorce de Chêne; Ger. Flüssiges Eichenrindenextrakt.)

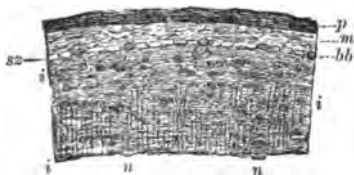
**Manufacture**: Macerate, percolate 100 Gm. with glycerin 10 Cc. + diluted alcohol 90, finishing with latter alone q. s., evaporate to 100 Cc. Dose,  $\mathfrak{m}15$ –60 (1–4 Cc.).

**Unoff. Preps.**: *Decoction*, 5 p. c., dose,  $\bar{3}$ ss–1 (15–30 Cc.); *Extract*, dose, gr. 3–10 (.2–6 Gm.). *Poultice*.

**PROPERTIES**.—Astringent, tonic, hæmostatic.

**USES**.—Similar to tannin, anciently for dysentery, hæmoptysis, uterine hemorrhages (by bark pessaries); crushed leaves for relaxed parts, now used especially for bronchial flux; bathe body with decoction for marasmus, scrofula, intermittents, chronic diarrhœa, cholera infantum; injection for leucorrhœa, gonorrhœa; wash in prolapsus ani, hemorrhoids, ulcers; gargle for prolapsed uvula; poultice in gangrene; powder in tooth powders and washes.

FIG. 84.



*Quercus alba*: bark, cross-section, magnified 10 diam.; p, cork; m, outer bark; t, inner bark; sz, group of stone-cells; bb, bast fibre; n, longitudinal fibre.

Persons working in tan vats are said never to have intermittents or phthisis; its value in tanning, due mostly to ingredients, having the property of "filling" the leather, such being of little service in medicine. The wood is very durable, hence valuable in shipbuilding, furniture, arts; much used by wheelwrights, coopers, etc.

#### Allied Plants:

1. *Quercus veluti'na* (*coccin'ea* var. *tincto'ria*), *Black (Scarlet) Oak* (*Quercitron*).—The (inner) bark, official 1820–1880. Trees 24–30 M. (80–100°) high, 1–1.2 M. (3–4°) thick, leaves oblong, lobed, 15–20 Cm. (6–8') long, mucronate; fruit, acorns, 12–18 Mm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') long, 12 Mm. ( $\frac{1}{2}$ ') thick, cupule thick, shallow; bark resembles official,

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only reddish-brown, gives saliva brownish-yellow color. Contains tannin 6–12 p. c., quercitrin (red-brown coloring-matter, dyeing yellow wool, silks, etc.),  $C_{36}H_{38}O_{20}$ , with diluted acids yields isodulcite,  $C_6H_{14}O_6$ , and yellow quercetin,  $C_{24}H_{16}O_{11}$ . In the South barks of *Q. nigra* and *Q. digitata* (*falcata*), used for this, although these have a much coarser texture and a deep reddish-brown color.

2. *Q. Ro'bur*, *Common European or English Oak*.—Tall tree, 24–30 M. (80–100°) high, having 3 forms: (a) *Q. pubes'cens* (old leaves hairy); (b) *Q. peduncula'ta* (leaves smooth, pistillate flowers, and fruit on peduncles); (c) *Q. sessiliflo'ra* (leaves smooth, flowers and fruit sessile, petioles long). These have many varieties, all resembling official.

3. *Q. digita'ta* (*falca'ta*, *L. falcatus*—i. e., leaf-lobes scythe-shaped), *Spanish or Red Spanish Oak*.—Maryland, Florida. Tree 18–21 M. (60–70°) high, leaves grayish, 3–5-lobed, finger- or scythe-shaped. Bark rich in tannin, wood reddish, coarse-grained; used in tanning, sometimes called quercitron.

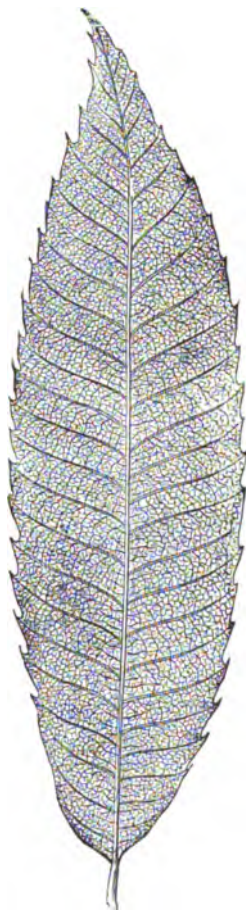
4. *Q. marylan'dica* (*ni'gra*, *ferrugin'ea*), *Black, Barren, or Iron Oak* (*Black Jack*).—Southern States. Tree 9–12 M. (30–40°)

FIG. 85.



*Castanea dentata*.

FIG. 86.



*Castanea*: leaf, one-half natural size.

high, leaves cuneate, 3–5-lobed, rusty, pubescent beneath, shining above. Of little value.

5. *Q. virginia'na* (*vi'rens*, *L. vireo*, green, fresh, flourishing), *Live Oak*.—Maryland, Florida. Tree 12–18 M. (40–60°) high. Bark rich in tannin, wood fine-grained; used in shipbuilding.

6. *Q. su'ber*, *Cork Oak*, *Alcornoque* (*Savanna Bark*).—Mediterranean Basin, S. United States. Small tree, 9–15 M. (30–50°) high, leaves toothed, ovate; bark with an elastic suberous layer 2.5–5 Cm. (1–2') thick, collected every 8 to 10 years, and constitutes our cork of commerce. When finely powdered, sold as suberin for absorbent purposes, which name is applied to one of its constituents (fat). There are about 80 species of *Quercus*, ranging from shrubs to trees; one-half of these grow in the United States, and may, with their acorns, be used similarly. Acorns sometimes are roasted = *semen quercus tostum*, and used as a substitute for coffee; contain fixed oil, starch, citric acid, uncrystallized and quercite sugars.

7. *Castanea denta'ta*, *Chestnut*.—The dried leaves, collected Sept.–Oct., while still green; official 1870–1900; N. America, W. Asia, S. Europe. Stately tree, 24–30 M. (80–100°) high; wood light, durable; flowers in 3's, monœcious—staminate and pistillate, involucre 4-lobed, becoming prickly; fruit, 4-valved involucre enclosing 1–3 1-seeded nuts. Leaves 15–25 Cm. (6–10') long, 5 Cm. (2') wide, lanceolate, acuminate, mucronate, petiolate, feather-veined, sinuate-serrate, dark green above, smooth, odor slight; taste astringent; contains tannin 9 p. c., resin, fat, gum, albumin, ash 6 p. c.; fruit contains starch 35 p. c., fat 2 p. c., proteids 3–4 p. c., sugar 1–2 p. c.; solvents: boiling water, alcohol partially. Tonic, mild sedative, astringent; whooping-cough, controlling paroxysms, dysentery; wood resists exposure greatly, nuts a delicacy, thoroughly edible. Dose, gr. 15–60 (1–4 Gm.); fluidextract, Mxv–60 (1–4 Cc.).

8. *C. (Fagus) pu'mila*, *Castanea* (*Chinquapin*).—The bark, official 1820–1860. Delaware–Mississippi. Shrub or small tree, 6–15 M. (20–50°) high, 25–37.5 Cm. (10–15') thick, largest being south; leaves differ from chestnut in having underside white, downy; bark grayish, brownish inside; fruit rounded, conical, 12 Mm. ( $\frac{1}{2}$ ') long, 9 Mm. ( $\frac{3}{8}$ ') wide at base, same constituents and taste as chestnuts. Bark contains tannin, resin, extractive. Used as tonic, astringent for intermittents.

9. *Fa'gus america'na* (*ferrugin'ea*), *American Beech*.—Tree, 22.5–30 M. (75–100°) high; bark and leaves used, the latter oblong-ovate, taper pointed, dentate, petioles and midrib soon (nearly) naked, prickles of fruit recurved or spreading; astringent, tonic.

#### GALLA. NUTGALL.

*Quercus infectoria*, Olivier. } An excrescence on this plant caused by the punctures (stings) and deposited ova of *Cynips tinctoria*, Olivier.

*Habitat.* Mediterranean Basin eastward, Greece, Persia, Asia Minor, Syria.

*Syn.* Galls, Aleppo, Turkey or Mecca Galls, Mad Apple, Dead Sea Apple, Apple of Sodom, Dyers' Oak, Galla Halepense, Turcica, Levantica, Tinctoria, Quercina; Fr. Galle de Chêne, Noix de Galle; Ger. Gallæ, Galläpfel, Gallen.

*In-feo-to'ri-a.* L. *infectorius*, dyeing, staining; *in*, in + *facere*, to do, make, taint —i. e., species easily infected or stung, thereby yielding dyeing product.

*Gal'la.* L. for gall, fr. Eng. *gallen*, galled — chafed, as a horse, or from its gallish taste.

**FAGACEÆ.**

**PLANT.**—Shrub 1.3–2 M. (4–6°) high, seldom tree-like; leaves 5–7.5 Cm. (2–3') long, obovate, shallow, roundly lobed; flowers May, catkins; fruit acorn, 2.5–4 Cm. (1–1½') long, September. Differs from *Q. alba* in being a shrub, leaves less indented, acorns longer, cupules different shaped. **GALLS**, subglobular, 1–2 Cm. ( $\frac{2}{5}$ – $\frac{4}{5}$ ') thick, tuberculated above, smooth below, heavy, hard, olive-green or blackish-gray, often with circular hole near the middle, communicating with central cavity, containing either the partly developed insect or pulverulent remains left by it; nearly inodorous; taste strongly astringent. On outside of cavity have stone-cells, outside of these is parenchyma containing the tannin. Light, spongy, and whitish-colored nutgalls should be rejected. *Solvents*: alcohol; water. Dose, gr. 5–30 (.3–2 Gm.).

**Commercial.**—The tender bark of shoots and the leaf-buds are easily stung and punctured by the horny ovipositors of the female hymenopterous insects, and into such galled places (wounds) they deposit one

FIG. 87.



Galla: a, entire; b, vertical section.

or more eggs, which set up irritation, and in consequence of morbid growth a small tumor of hypertrophied tissue quickly forms enclosing the egg; this grows with the gall, and when the latter is fully developed the former is hatched into a larva or grub, which begins to feed on the juices of the central cavity; this cavity, never larger than the larva, soon becomes lined with a wall of hard cells, and the entire gall likewise hardens. When the grub is full grown, it passes into the pupa (chrysalis) stage, and in time is transformed into a 4-winged fly, 6 Mm. ( $\frac{1}{4}$ ') long, when it either must die or cut itself out with its mandibles, thus making a small round opening midway the gall; if this is not done, the remains will be revealed upon cracking open the unpunctured gall. There are several varieties, named according to place of production, although color is the guide to quality: 1. *Aleppo, Syrian*. Bluish or blackish, usually collected before fly has escaped. 2. *Smyrna*. Grayish-olive, intermixed with white galls (least valuable, generally with large openings). 3. *Sorian*. Blackish, size of a pea. These 3 are exported from Trebizond, Smyrna, Bassorah, Calcutta, Bombay. 4. *European*. Light colored, more spongy, contain much tannin, produced by different cynips. 5. *American*. (a) *Q. alba*, light, spongy, little tannin; (b) *Q. virginiana (virens)*, Texas,



resembles Aleppo, not tuberculated, contain tannin 40 p. c.; (c) *Q. lobata*, California, 5 Cm. (2') thick, orange-brown, glossy, soft, spongy inside, contain much tannin.

CONSTITUENTS.—Tannin 50–60 p. c. (white galls 20–30 p. c.), Gallic acid 2–3 p. c., mucilage, sugar, resin; in the nucleus starch.

**Acidum Tannicum.** Tannic Acid,  $\text{HC}_{14}\text{H}_9\text{O}_9$ , *official*.—Syn., Gallo-tannic Acid, Digallic Acid, Tannin; Fr. Acide tannique; Ger. Gerbsäure.) This monobasic organic acid is obtained by exhausting powdered nutgall with warm water, cooling, agitating the filtrate with one-fourth volume of ether; the emulsion in 10 days separates, yielding an upper ethereal layer (containing coloring-matter, fat, resin, gallic and ellagic acids), which is discarded, and a lower aqueous fluid, containing tannin, which is concentrated to a syrupy consistence and spread on tin or glass plates to dry; occurs as a light yellowish, amorphous powder, faint, characteristic odor, strong astringent taste, darkens by age; soluble in 0.34 part water, 0.23 alcohol, 1 glycerin (with heat), insoluble in absolute ether, chloroform, benzene, ash 0.2 p. c.; being a glucoside splits easily into glucose and digallic acid by acids or ferments (pectase, etc.); is precipitated blue-black by ferric salts; white with gelatin, blue with lime water; aqueous solution precipitates nearly all alkaloids, glucosides, and T. S. of gelatin, albumin, starch, tartar emetic (dis. from gallic acid). *Tests*: 1. 2 Gm. + boiling water 10 Cc., let cool, should get no turbidity on diluting 5 Cc. of the solution with 10 Cc. alcohol (abs. of gum, dextrin), or with 10 Cc. water (abs. of resinous substances). *Impurities*: Gallic acid, glucose, dextrin, gum, resin, coloring-matter. *Incompatibles*: Alkalies, alkaloids, emulsions, gelatin, ferric salts, mineral acids, salts of antimony, lead, and silver. Dose, gr. 1–20 (.06–1.3 Gm.).

**Acidum Gallicum.** Gallic Acid,  $\text{HC}_7\text{H}_5\text{O}_5 + \text{H}_2\text{O}$ , *official*.—(Syn., Trioxysalicylic acid, Dioxysalicylic acid; Fr. Acide gallique; Ger. Gallussäure.) This organic acid is usually prepared from tannic acid by boiling 15 minutes 1 part (or 2 parts nutgall) with 1 part sulphuric acid and 5 parts water; strain while hot, set aside for crystallization; a once popular method consisted in exposing to the air a mixture of nutgall and distilled water in a thin paste for a month, adding occasionally water to keep semifluid, express, reject liquid, boil residue with distilled water, filter hot through animal charcoal, set aside to crystallize; occurs in white or fawn-colored silky needles; odorless; astringent, acidulous taste, permanent, soluble in 83.7 parts water, 4.14 alcohol, 40 ether, 12 glycerin; heated to 100° C. (212° F.) loses water of crystallization (9.58 p. c.), melts, no residue. It is the hydride of tannic acid, while this latter is the anhydride of gallic acid, a relationship and convertibility shown by the equations: (1)  $2 \text{HC}_7\text{H}_5\text{O}_5 - \text{H}_2\text{O} = \text{HC}_{14}\text{H}_9\text{O}_9$ . (2)  $\text{HC}_{14}\text{H}_9\text{O}_9 + \text{H}_2\text{O} = 2\text{HC}_7\text{H}_5\text{O}_5$ . *Tests*: 1. Sodium hydroxide T. S. gives deep green, changing to reddish by acids. Aqueous solution does not precipitate alkaloids, glucosides, T. S. of albumin, gelatin, starch. *Impurities*: Tannic acid, etc. *Incompatibles*: Ferric and metallic salts, spirit of nitrous ether. Dose, gr. 5–20 (.3–1.3 Gm.).

## FAGACEÆ.

PREPARATIONS.—I. NUTGALL. 1. *Tinctura Gallæ*. Tincture of Nutgall. (Syn., Tincture of Galls; Fr. Teinture de Noix de Galle; Ger. Tinctura Gallarum, Galläpfeltinktur.)

*Manufacture*: 20 p. c. Percolate 20 Gm. with glycerin 10 Cc., alcohol 90, finishing with latter alone q. s. 100 Cc. Dose, ʒss–2 (2–8 Cc.).

2. *Unguentum Gallæ*. Nutgall Ointment. (Syn., Ointment of Galls; Fr. Pommade de Noix de Galle; Ger. Galläpfelsalbe.)

*Manufacture*: 20 p. c. Nutgall 20 Gm., ointment 80; avoid metallic utensils.

*Unoff. Preps.*: *Fluidextract*, dose, m̄v–30 (.3–2 Cc.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.). *Unguentum Gallæ cum Opii* (Br., nutgall 18 p. c. + opium 7.5 p. c.).

II. TANNIC ACID.—1. *Glyceritum Acidi Tannici*. Glycerite of Tannic Acid. (Syn., Fr. Glycérôle de Tannin, Glycérine tannique; Ger. Tanninglycerit (glycerol).)

*Manufacture*: 20 p. c. Tannic acid 20 Gm., glycerin 80. Heat together until dissolved.

2. *Trochisci Acidi Tannici*. Troches of Tannic Acid. (Syn., Fr. Tablettes (Pastilles) de Tannin; Ger. Tanninpastillen.)

*Manufacture*: Tannic acid 6 Gm., sugar 65, tragacanth 2, stronger orange-flower water q. s. 100 troches. Dose, 1–3 troches.

3. *Unguentum Acidi Tannici*. Ointment of Tannic Acid. (Syn., Fr. Pommade de Tannin; Ger. Tanninsalbe.)

*Manufacture*: 20 p. c. Tannic acid 20 Gm., glycerin 20, ointment 60; avoid iron utensils.

4. *Collodium Stypticum*. 20 p. c.

*Unoff. Prep.*: *Suppositoria Acidi Tannici* (Br., each contains tannic acid gr. 3—.2 Gm.).

III. GALLIC ACID.—1. *Pyrogallol*. *Pyrogallol*,  $C_6H_3(OH)_3$ . (Syn., Pyrogallie Acid, Acidum Pyrogallicum; Fr. Acide pyrogallique; Ger. Pyrogallolum, Pyrogallussäure.) Triatomic phenol, obtained by heating under pressure gallic acid (dried or in aqueous solution),  $HC_7H_5O_5 + \text{heat} = C_6H_3(OH)_3 + CO_2$ ; yield 30–75 p. c. It is in light white laminæ or fine needles, odorless, bitter taste, acquiring grayish tint on exposure, soluble in 1.6 parts water, 2 alcohol, 1.1 ether, no residue. Should be kept in dark, amber-colored bottles.

PROPERTIES.—I. NUTGALL: Astringent, tonic; constringes muscular tissue, thus checking secretions, hemorrhages, local inflammations, etc.

II. TANNIC ACID: Local astringent. Internally—contracts blood-vessels, restrains peristalsis (constipates), coagulates mucous secretions, prevents secretion of gastric and intestinal juices, precipitates pepsin, etc.; it is converted into gallic acid in the intestines, and until this change is effected it cannot become absorbed to act as a remote or systemic astringent, simply being able to control locally gastric and intestinal bleeding. Externally—astringent, coagulates blood (forming

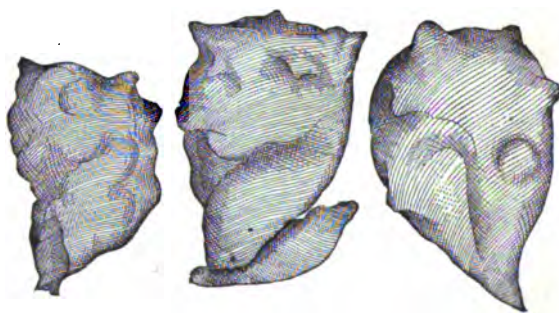
a clot), albumin, and gelatin (tans tissues), is hæmostatic, antiseptic, depressant, irritant; the salts have no astringency.

III. GALLIC ACID: Mild astringent, does not coagulate blood, hence recognized only as remote astringent, but not to raw and bleeding surfaces; internally—controls systemic hemorrhages (contracts blood-vessels), decreases secretion of urine and sweat; does not constipate like tannic acid, and is eliminated by the kidneys unchanged.

USES.—I. NUTGALL: Chronic diarrhœa, dysentery, gleet, leucorrhœa, antidote to tartar emetic and alkaloids (emetine, morphine, colchicine, strychnine, etc.), constricts the stomach, thus delaying absorption, forming of the alkaloids insoluble tannates. In cases of poisoning give infusion freely. Locally infusion as gargle for relaxed mucous membrane of mouth, throat, vagina, rectum; ointment with 5–10 p. c. opium, good in hemorrhoids after inflammatory stage. Chiefly used for obtaining tannic and gallic acids, for ink, dyeing, tanning.

II. TANNIC ACID: Hemorrhages (epistaxis, uterine, etc.), diarrhœa, dyspepsia, cholera, relaxed uvula, coryza, inflamed fauces, diphtheria, toothache, aphthæ, excessive salivation, leucorrhœa, chapped nipples, gleet, gonorrhœa, ulcers, piles, chilblains, chronic bronchitis, whooping-cough, phthisis, influenza, ozæna, fissures, hemorrhoids, prolapsus ani and uteri, vesical catarrh, hemorrhage after extracting teeth, spongy gums (contracts vessels, checks absorption, hence loosening of teeth), obtunds sensitive dentine, either alone or combined with morphine and creosote, to toughen mucous membranes, skin around nipples, conjunctivitis,

FIG. 88.



Chinese nutgalls.

erectile tumors, ingrowing toenails; aqueous solutions (1 to 50) may be injected into urethra and bladder, but should never be used hypodermically.

III. GALLIC ACID: Menorrhagia, purpura, epistaxis, hæmoptysis, hæmatemesis, hemorrhage of stomach, intestines, lungs, kidneys, night-sweats, polyuria, Bright's disease, dyspepsia, bronchitis, hemorrhoids, chronic ulcers, pyrosis, alopecia.

## ULMACEÆ.

IV. PYROGALLOL: Psoriasis, syphilitic ulcers, lupus, epithelioma, parasiticide for ringworm. Should not be applied over extensive surface, as absorption may poison; not used internally; ointment 1–5–10 p. c.

*Allied Products:*

1. *Chinese Nutgalls* (*Rhus semialata*) by sting of *Aphis chinensis*.—Galls 4–5 Cm. ( $1\frac{3}{4}$ –2') long, ovate, irregular, tuberculate, grayish-downy, hollow; shell thin, fragile, containing many insect-remains.

2. *Japanese Nutgalls* (*R. semialata* or *R. japonica*) resemble Chinese.—The tannic acid of these differs from that of official galls.

3. *Vallonea*, *Acorn Cups* of many *Quercus* species (*Q. Robur*, *Q. Vallo'nea*, *Q. Ægilops*), 2.5 Cm. (1') in diameter, with thick, spreading scales, strongly astringent taste, largely used in tanning.

4. *Tamarisk Galls* (*Tam'arix articulata orientalis*), *T. africa'na*, *T. gal'lica*).—Asia, Africa, 3–12 Mm. ( $\frac{1}{8}$ – $\frac{1}{2}$ ') thick, subglobular, knotty, contain tannin 40–50 p. c.

5. *American Nutgalls* (*Q. alba*, *Q. virginiana (virens)*, *Q. lobata*), first poor in tannin; second (Texas) like Aleppo, but not tuberculate, tannin 40 p. c.; third (California), 5 Cm. (2') thick, glossy, orange-brown, rich in tannin.

## 19. ULMACEÆ. Elm Family.

Ul-ma'se-e. *Ulm-us* + aceæ, fr. Saxon *elm* or *ulm*—i. e., its original name in all Celtic dialects. Trees, shrubs. Distinguished by leaves alternate, serrate, stipulate; sap not milky; flowers small, 3–9-parted or sepals; petals none, stamens 3–9; ovary 1-celled, superior; fruit 1-seeded, samara, drupe or nut; universal; demulcent, nutritive, astringent, tonic, timber.

Genus: 1. *Ulmus*.

## ULMUS. ELM.

*Ulmus*  
*fulva*, Michaux. } The dried bark deprived of its periderm.

*Habitat.* N. America, New England, S. Carolina, west to Louisiana, Nebraska.

*Syn.* Slippery Elm, Moose-, Red-, Indian-, Sweet-, Rock or American Elm; British Tea (the leaves), Cortex Ulmi Interior; Fr. Écorce d'Orme (fauve); Ger. Ulmenrinde, Rüsterrinde.

*Ulmus.* L. see etymology, above, of Ulmaceæ.

*Ful'va.* L. *fulvus*, deep yellow, tawny—i. e., the color of the liber bark.

PLANT.—Large tree, 15–18 M. (50–60°) high, 3–6 M. (1–2°) thick; bark and wood reddish-brown, branches rough, whitish; leaves large 10–20 Cm. (4–8') long, 5–7.5 Cm. (2–3') broad, oblong, acuminate, unequal at subcordate base, unequally serrate, pubescent; rough on both sides, petiolate, buds covered with dense russet down; flowers April, small, appearing before leaves, sessile, in clusters, calyx downy, corolla wanting; fruit samara, 12–18 Mm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') long, flat, broadly oblong, entire, notched, 1-celled, wing yellow, silky with short fulvous

hairs. BARK (inner), in flat pieces, varying in length and width, 3–4 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') thick, outer surface light brown, with occasional dark brown patches of periderm, inner surface yellowish-brown, fracture fibrous, somewhat mealy; odor slight, distinct (fenugreek-like); taste mucilaginous; ground elm contains a few nearly spherical starch grains .005–.010 Mm. ( $\frac{1}{8000}$ – $\frac{1}{2500}$ ') in diameter; powder light fawn. Solvent: water. Dose, ʒij–4 (8–15 Gm.).

ADULTERATIONS.—BARK: More brittle, less fibrous and mucilaginous barks; POWDER: Corn meal, flour, starches.

Commercial.—This tree flourishes in open high places, firm dry soil; it is distinguished from *U. americana*, *White Elm*, by its rougher branches, leaves, and buds, also by character of flowers and seeds. Bark should be collected in spring, deprived of epidermis, and dried. For this, entire trees are felled in Michigan and other Western States, peeled and wood burnt or allowed to decay.

CONSTITUENTS.—Mucilage, starch; European bark also contains tannin and bitter principle.

Mucilage.—Resembles that of flaxseed; is precipitated by lead acetate, but alcohol separates from its solution a gelatinous liquid.

PREPARATIONS.—1. *Mucilago Ulmi*. Mucilage of Elm. (Syn., Fr. Mucilage d'Écorce d'Orme fauve; Ger. Ulmenrindenschleim.)

Manufacture: 6 p. c. Digest 6 Gm. in water q. s. 100 Cc. for 1 hour on water-bath, strain; if to be free from starch, must use cold water. Should be freshly made when wanted. Dose, *ad libitum*.

Unoff. Preps.: Poullice. Uterine tents, etc.

PROPERTIES.—Demulcent, emollient, nutritive.

USES.—Dysentery, diarrhoea, diseases of urinary passages, bronchitis. Externally—finely ground or powdered bark mixed with hot water into pasty mass and used as a poullice for inflammations, boils, etc.; in shape of tents to dilate fistulæ, strictures, os uteri, also in form of vaginal and rectal suppositories.

Allied Plants:

1. *Ulmus campestris*.—Europe. Bark thinner than official, cinnamon color, mucilaginous, bitterish, astringent. *U. effusa*, *Black Elm*, bark very similar. *U. americana*. New England, chiefly shade tree. *U. ala'ta*, *Wahoo*. S. United States. Bark used in making ropes.

## 20. MORACEÆ. Mulberry Family.

Mo-ra'se-e. L. *Mor-us* + aceæ, fr. Celtic *mor*, black—*i. e.*, alluding to the fruit's color. Trees, shrubs, herbs. Distinguished by leaves alternate or opposite, stipulate; sap milky; flowers monœcious or diœcious; calyx 4–5-parted, petals none, staminate paniced, pistillate capitate, cymose; ovary superior, 1-celled, ovule solitary; fruit various; universal; narcotic, sedative, tonic, astringent, fibres.

Genera: 1. *Ficus*. 2. *Humulus*. 3. *Cannabis*.

## MORACEÆ.

## FICUS. FIG.

**Ficus**  
**Carica, Linné.** } The partially dried fruit.

*Habitat.* W. Asia; cultivated in subtropics, Italy, France, California.

*Syn.* Ficus Passa, Fici, Fructus Caricæ; Fr. Figue; Ger. Caricæ, Feigen.

**Ficus.** L. fr. Celtic *figueren*, Teutonic *siege*, Saxon *fic*, Eng. fig, Gr. *συκή*.

**Car'i-ca.** L. name used by the Latins for dried fig, fr. *Caria*, in Asia Minor—i. e., the habitat.

**PLANT.**—Small tree 4.5–7.5 M. (15–25°) high, 10–20 Cm. (4–8') thick, trunk divided into many spreading branches; bark reddish or gray; leaves 10–12.5 Cm. (4–5') long, 3–5-palmately bluntly lobed,

FIG. 89.



*Ficus Carica*: a, vertical section of fruit; b, staminate flower; c, pistillate flower.

dentate, deep green, downy beneath; flowers staminate and pistillate, in the hollow, thick, fleshy-walled receptacle, which becomes the fruit. **FRUIT** (fleshy receptacle, bearing fruit upon its inner surface), compressed or irregular shaped, fleshy, brownish-yellow, frequently with an efflorescence of sugar, apex with small scaly orifice, base with scar or short stalk; internally hollow, with many small brownish-yellow, glossy, hard achenes; odor distinct, fruity; taste sweet, pleasant; pear-shaped when softened in water 5–7.5 Cm. (2–3') long. Dose, *ad libitum*.

**Commercial.**—Figs may dry on trees, but usually are gathered and dried by the sun, sometimes in ovens, packed with pressure into drums or boxes, under the name of *natural figs*; others are kneaded, squeezed, pulled so as to be pliant, then packed under name of *pulled figs*. The largest and best are Smyrna, Turkey, or Eleme figs; the smaller and less pulpy are Greek figs.

CONSTITUENTS.—Grape-sugar 62 p. c., gum, fat, phosphates, chlorides, etc., achenes and cellular tissue 15 p. c., water 16 p. c.

FIG. 90.



*Ficus Carica*: a, vertical section of common receptacle; b, ripened fruit; c, staminate flower; d, pistillate flower.

PREPARATION.—1. *Confectio Sennæ*, 12 p. c.

PROPERTIES.—Nutritious, demulcent, laxative, dietetic.

USES.—Habitual constipation, eaten as a diet. The indigestible seeds and skin act mechanically to set up intestinal irritation, hence purgation, diarrhœa, pains, flatulency. May roast or boil, split open and apply as a suppurative poultice to gum-boils, abscesses of anus and vulva, cancerous fetor, etc.

*Allied Plants*:

1. *Morus rubra*, *Red Mulberry*.—N. America. Fruit in dense spikes with coalesced perianths, 2.5 Cm. (1') long, dark purple, fleshy; contains sugar 10 p. c., pectin, citrates, malates; refrigerant, flavoring.

2. *Dorstenia Contrayerva*, *Contrayerva*.—The root, official 1820–1860. W. Indies, C. and S. America. Acaulescent perennial; leaves lobed, radical, 10 Cm. (4') long; flowers staminate and pistillate, fruit capsule, disperses seeds by hygroscopism; root (rhizome) fusiform, 1–2-headed, 5–7.5 Cm. (2–3') long, 12 Mm. (½') thick, reddish; taste acrid, bitter; contains volatile oil, resin, bitter principle, starch. Used as stimulant, tonic, diaphoretic, for low fevers, typhoid, diarrhœa, dysentery, serpent bites; in decoction, tincture. Dose, gr. 30 (2 Gm.).

## HUMULUS. HOPS.

**Humulus** ) The carefully dried strobiles, bearing their natural  
**Lupulus**, Linné. ) glandular trichomes.

*Habitat*. N. temperate zone, in hedges, thickets; cultivated in N. America (New England, N. Y., Mich.), Europe (England, Germany), C. Asia, Brazil, Australia.

*Syn.* Br. *Lupulus*, *Strobili* (Humuli) *Lupuli*, *Hop*, *Hop Vine*, *Bine*, *Bur*, *Seeder*; Fr. *Houblon*; Ger. *Hopfen*.

**Hu'mu-lus**. L. *humus*, the ground—i. e., the plant creeps on the ground unless supported.

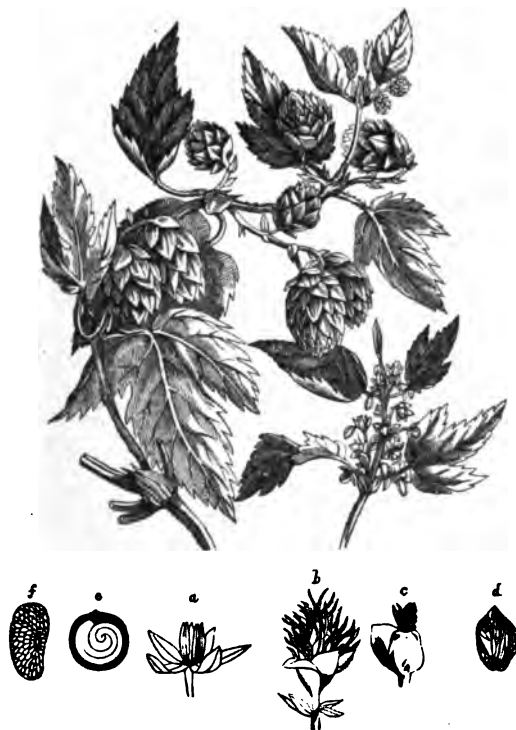
**Lu'pu-lus**. L. dim. of *lupus*, a wolf—i. e., it is wolfish, because it strangles the shrubbery upon which it climbs.

*Hops*, OE. *hoppen*, to climb—i. e., plant leaps or hops from one place or support to another.

## MORACEÆ.

**PLANT.**—Perennial, herbaceous twiner; root large, thick, branched; stems several, 6 M. (20°) long, striated, angular, rough, flexible, entwining left to right; leaves 7.5–10 Cm. (3–4') long, cordate, 3–5-palmate-lobed, petiolate, scabrous with minute prickles, stipulate, dark green; flowers July–August, dioecious, axillary, the staminate yellowish-white racemes, pistillate densely leafy, pale green, cone-like spikes, which produce the fruit (strobile). **STROBILES**, ovoid-cylindrical, about 3 Cm. (1½') long, consisting of a thin, hairy flexuous rachis and numerous yellowish-green to pale brown obliquely ovate membranaceous

FIG. 91.



*Humulus Lupulus*: a, staminate flower; b, pistillate flower; c, sepal; d, bract; e, embryo; f, lupulinic gland (lupulin).

scales with a glandular-hairy base, frequently infolded on one side, enclosing a subglobular, light brown, very glandular achene entirely covered with numerous yellow, shining glands (lupulin) in which most of the drug's strength resides; odor strong, agreeable; taste aromatic, bitter. Should not be used after a year old. *Solvents*: diluted alcohol; boiling water. *Dose*, ʒss–1 (2–4 Gm.).

*Commercial.*—Hops ripen in September, when they are picked, dried carefully by fire in kilns, packed in hempen bales or bags, and sent into market. If of good color and aroma, are usually sold in bulk for brewing and the retail drug trade, while those of off-color (brown by



age and exposure) and of rankish odor (valerianic acid), hence inferior, are tightly compressed into varying-size rectangular cakes; or they may be bleached by sulphur dioxide, thus retarding oxidation, and then bartered loosely, or may be sprinkled with alcohol before pressing, which develops special odors, yet prevents that of valerianic acid, but when thus treated should be aired for a month at least before being used in medicine or beer. Manufacturers of the beverages will not knowingly make use of such, but this seems to be without valid reason.

**CONSTITUENTS.**—Volatile oil 0.8 p. c., resin 9–18 p. c., asparagin 1 p. c., choline, trimethylamine, pectin, sugar, tannin,  $C_{25}H_{41}O_{13}$ , 4 p. c., wax, phosphates, nitrates, malates, citrates, ash 7–10 p. c. (K, Ca, Si, —).

**PREPARATIONS.**—1. *Tinctura Humuli*. Tincture of Hops. (Syn., Br. *Tinctura Lupuli*; Fr. *Teinture de Houblon*; Ger. *Hopfentinktur*.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with diluted alcohol q. s. 100 Cc. Dose,  $\mathfrak{z}\text{j}$ –2 (4–8 Gm.).

*Unoff. Prep.*: *Extract*, dose, gr. 3–10 (.2–.6 Gm.). *Fluidextract*, dose,  $\mathfrak{M}\text{xv}$ –60 (1–4 Cc.). *Infusum Lupuli* (Br.), 5 p. c., dose,  $\mathfrak{z}\text{j}$ –4 (30–120 Cc.). *Poultice*.

**PROPERTIES.**—Tonic, sedative, anodyne, hypnotic. Somewhat diaphoretic, astringent, anaphrodisiac, diuretic, stomachic, carminative. Increases heart action, skin circulation; after slight cerebral excitement have calm, soporific effect. Tonic effect is due to bitter principle—lupamaric (lupulinic) acid; stimulant then sedative, due to volatile oil. Aromatic and bitter virtues reside mostly in the glands (lupulin).

**USES.**—Dyspepsia, delirium tremens, priapism, seminal emissions, incontinence of urine, irritable bladder. Externally—rheumatism, abscesses, spasms, colic, toothache, bruises; for these, use poultice made by moistening hops with hot water, vinegar, alcohol or laudanum, enclosing in porous cloth and applying while hot to painful part. Tincture with tincture of capsicum good following a debauch as a substitute for alcoholic drinks.

*Allied Plant*:

1. *Urtica dioica*, *Nettle* (*Stinging Nettle*), Urticaceæ.—N. America, Europe. Plant .6–1 M. (2–3°) high, very bristly, stinging, leaves ovate, heart-shaped, pointed, serrate, downy beneath, upper stem downy, spike much branched. Tonic, astringent, uterine hemorrhage. Dose, gr. 15–30 (1–2 Gm.).

## LUPULINUM. LUPULIN.

**Humulus**  
**Lupulus**, Linné. } The glandular trichomes separated from the fruit.

*Syn.* Lupulina, Lupulinic Glands; Fr. Lupuline, Lupulite; Ger. Glandulæ Lupuli, Hopfenmehl.

Lupulin consists of minute granules; in mass bright brownish-yellow, becoming yellowish-brown and resinous; its component trich-

**MORACEÆ.**

comes inflammable, under microscope somewhat globular or ellipsoidal, 0.1–0.3 Mm. ( $\frac{1}{250}$ – $\frac{1}{80}$ ') broad, reticulate, multicellular; odor and taste characteristic of hops. *Tests*: 1. When agitated with water should give no sediment upon standing (sand, etc.). 2. When ignited, residual ash should not be more than 10 p. c. 3. Ether should dissolve 60 p. c., and this solution when evaporated should leave soft extract with hop odor. *Solvents*: alcohol; ether; boiling water. Dose, gr. 5–15 (.3–1 Gm.).

*Commercial*.—Lupulin is separated by handling or thrashing dried strobiles or by picking off scales, then shaking and rubbing glands through a fine sieve. If very gritty, it may be washed in water, when the sand settles to the bottom, after which the lupulin should be well dried and preserved in bottles. Hops yield of these glands 8–16 p. c.

*CONSTITUENTS*.—Choline (formerly lupuline), Volatile oil 3 p. c., Lupamaric acid,  $C_{25}H_{35}O_4$ , resin, wax (myricin), ash 5 p. c.

*Choline*.—This results possibly from the decomposition of lecithin, and on boiling yields trimethylamine; it is a volatile, liquid alkaloid, having coniine-like odor, alkaline, not bitter.

*Volatile Oil*.—Obtained by distillation; consists of a lighter portion,  $C_{10}H_{16}$ , and a heavier portion, valerol,  $C_6H_{10}O$ , from which latter by gradual oxidation valerianic acid is obtained.

*Lupamaric Acid*.—Obtained by treating ethereal extract with alcohol (leaving wax behind), evaporating; dissolve residue in ether, shake solution with potassium hydroxide solution (removing resin). Shaking with water dissolves potassium lupamarate, which is precipitated by copper sulphate, and the precipitate decomposed by hydrogen sulphide yields the acid in bitter white crystals, turning yellow and resinous by age; red with nitric acid, changing to yellow on dilution or with alkalies, soluble in alcohol, ether, chloroform.

*PREPARATIONS*.—1. *Fluidextractum Lupulini*. Fluidextract of Lupulin. (Syn., Extractum Lupulini Fluidum, U. S. P. 1890; Fr. Extrait liquide de Lupuline; Ger. Flüssiges Lupulinextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\nu$ –30 (.3–2 Cc.).

2. *Oleoresina Lupulini*. Oleoresin of Lupulin. (Syn., Oleoresina Lupulinæ, Extractum Lupulini Æthereum; Fr. Oléorésine de Lupuline; Ger. Ätherisches Lupulinextrakt.)

*Manufacture*: Percolate 100 Gm. with acetone until exhausted, recover acetone by distillation on water-bath; yield 50–60 p. c. Should be kept in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

*Unoff. Preps.*: *Tincture*, 12 p. c. (alcohol), dose,  $\mathfrak{zss}$ –2 (2–8 Cc.). *Ammoniated Tincture*, 10 p. c. (ar. spts. ammonia), dose,  $\mathfrak{zss}$ –1 (2–4 Cc.). *Extract*, dose, gr. 5–10 (.3–.6 Gm.). *Pills*. The pills are best

FIG. 92.



Lupulin (fresh).

made into mass with a little ether, or by simply rubbing briskly with spatula, thus generating sufficient heat to cause cohesion.

PROPERTIES.—Stimulant, tonic, anodyne. About the same as hops, but stronger, consequently is, as a rule, preferable and more reliable.

USES.—About the same as hops.

### CANNABIS INDICA. INDIAN CANNABIS.

**Cannabis sativa**, Linné. } The dried flowering tops of pistillate plants, grown in E. Indies, gathered while fruits are undeveloped, and carrying the entire natural resin.

*Habitat.* Asia, Persia, hills of N. India; cultivated in India, Europe, C. and S. Russia, Brazil, W. and S. United States.

*Syn.* Indian Hemp, Black Indian Hemp, Bangue, Hashish, Halish, Gallow Grass, Hemp, Neck or Nick Weed, St. Andrew's-lace, Welsh Parsley, Bang, Bhang, Gunjah, Churrus, Charas, Ganja (dried flowers); Fr. Chanvre (Indien); Ger. Hanf, Indischer Hanf.

**Can'na-bis.** L. Gr. *kánvaβis*, hemp, fr. *ganeh*, its Arabic name. Celtic *can*, reed + *ab*, small—i. e., its slender stems.

**Sa-ti'va.** L. *sativus*, that which is sown or planted—i. e., in the gardens and fields for use.

**In'di-ca.** L. *Indicus*. Gr. *Ἰνδικός*, pertaining to India—i. e., its habitat.

PLANT.—Annual herb; stem 1–3 M. (3–10°) high, angular, tomentose; leaves palmate-compound; leaflets 5–7, linear, lanceolate, serrate;

FIG. 93.



*Cannabis sativa.*

flowers dioecious, yellow. FLOWERING TOPS, 5 Cm. (2') long, dark green or brownish compressed masses, consisting of densely paniculate branchlets, the inflorescence agglutinated with resinous exudation, commonly with few undeveloped digitate leaves of one or more linear-lanceolate leaflets; clothed with numerous sheathing, pointed bracts, each containing 2 small mature unfertilized pistillate flowers; odor agreeably narcotic; taste characteristic, acrid; powder should contain few or no pollen grains or stone-cells. *Solvent:* alcohol. Dose, gr. 1–5 (.06–.3 Gm.).

**MORACEÆ.**

*Commercial.*—This was known to the Romans, but not to the Egyptians. At present most of the tops are grown in the two districts, Bogra and Rajshahi, north of Calcutta, being known and called natively by the Hindustani names *ganja* or *gunjah*, and in London as *guaza*. Plants richest in resin grow at an altitude of 1,800–2,400 M. (6,000–8,000°), all being cultivated in rows, maturity being indicated by the brown color and falling of the larger leaves; then the flowering branches are cut off, cured by wilting, pressing, rolling, and shaking out of leaves and fruits, if any of latter have formed. The rolling and treading are performed by human feet—an art requiring training, the object being possibly to work resinous matter from stems into inflorescence tips. There are two commercial varieties: 1. *Round ganja*—requiring 4 days for kneading each branch into a cylindrical or terete mass. 2. *Flat ganja*—requiring 3 days for working into a flat form; the Bengal or Calcutta ganja (best) is brownish or dusty; the Bombay bright green color. The lack of uniformity in the drug may be due to presence of staminate flowers, leaves, fruits, cold weather, inopportune collecting (which should be within 4 days after maturity), intentional removal of resin, excessive age—losing most of its properties within a year. Great care is taken that the flowering tops be unfertilized, hence the suppression of male plants, as a single one is claimed to spoil an entire field; when cultivated, however, for fibre or seeds both male and female plants are grown together.

**CONSTITUENTS.**—Somewhat in dispute, but some claim these to be: Cannabin, oxycannabin, cannabinin, tetano-cannabinin, all resin-like bodies, mixed with alkaloids, 3 having been separated—Choline, trigonelline, muscarine; there are also present volatile oil,  $C_{10}H_{16}$ , 0.3 p. c., bitter principle, gum, sugar, potassium nitrate.

**Cannabin.**—This resin constituent (resinoid) 15–20 p. c., in which for years the medicinal virtue was supposed to reside, may be obtained by treating the drug with water and a solution of sodium carbonate, washing residue with water, drying, exhausting with alcohol, treating tincture with milk of lime, precipitating lime with sulphuric acid, adding animal charcoal to filtrate, filtering, concentrating and precipitating with water; it is a brown, amorphous resin, burning without ash, soluble in alcohol and ether, from the former being precipitated white by water.

**Choline** (*cannabinine, bilineurine*),  $C_5H_{15}NO_2$ .—Alkaloid, varnish-like mass or yellowish-brown syrupy liquid, odor of nicotine, soluble in ether and alcohol, sparingly in water; with alkalis gives trimethylamine (Siebold's cannabinine).

Kobert has obtained cannabindon,  $C_5H_{12}O$ , 3.3 p. c., a dark red syrupy liquid, soluble in alcohol, ether, oils; narcotic. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.). Wood, Spivey and Easterfield claim that there is present: terpene, sesquiterpene, crystalline paraffin,  $C_{29}H_{60}$ , cannabinol,  $C_{15}H_{24}O_2$ , which is a poisonous red oil, and to this they assign the medicinal properties; it readily oxidizes, losing its toxic properties, being in *churrus* to the extent of 33 p. c.; it is, however, not a definite chemi-

cal substance, its red resin being even more active, and may be identical with cannabindon.

PREPARATIONS.—1. *Extractum Cannabis Indicæ*. Extract of Indian Cannabis. (Syn., Extract of Indian Hemp; Fr. Extrait de Chanvre Indien; Ger. Indisch Hanfextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., distil, evaporate; yield 12–14 p. c. Dose, gr.  $\frac{1}{8}$ –1 (.01–.06 Gm.).

2. *Fluidextractum Cannabis Indicæ*. Fluidextract of Indian Cannabis. (Syn., Extractum Cannabis Indicæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Chanvre Indien; Ger. Flüssiges Indisch Hanfextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose, Mj–5 (.13–.3 Cc.).

3. *Tinctura Cannabis Indicæ*. Tincture of Indian Cannabis. (Syn., Fr. Teinture de Chanvre Indien; Ger. Indisch Hanftinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with alcohol q. s. 100 Cc. Dose, Mv–30 (.3–2 Cc.).

These preparations give varying results, but usually their value can be recognized by the color of the precipitate formed when added to water; if olive-green, it is active; if yellowish-brown, it is inert; thus, whatever there is that destroys chlorophyll injures the active principle.

PROPERTIES.—Anodyne, nervine, sudorific, narcotic, aphrodisiac, increases appetite. It excels even belladonna in perverting perception, condition, and relation of objects; some subjects become pugnacious, others have delightful intoxicating dreams, in which time, distance, and sound are magnified—a few minutes' dream extends over weeks, near objects as in infinite space, whispering as cannonading. Large habitual doses bloat the face, inject eyes, make limbs tremulous, weak, mind imbecilic, death by marasmus.

USES.—Neuralgia, distressing cough, gout, delirium tremens, tetanus convulsions, chorea, hysteria, mental depression, epilepsy, morphine and chloral habits, softening of the brain, nervous vomiting.

*Poisoning*: Have pleasurable intoxication, double consciousness followed by drowsiness, unconsciousness, collapse, insensibility, dilated pupils, rapid pulse, slow respiration, debility, pale clammy insensitive skin, catalepsy, excited passion; effects usually last 24 hours, and closely resemble those of opium, differing, however, in not constipating and in not lessening secretions; increases appetite. Give emetics, lemon juice to neutralize its effects, tannin, coffee, ammonia, strychnine, atropine, electricity, spirit of nitrous ether, artificial respiration; similar to hydrated chloral and opium.

*Incompatibles*: Strychnine, caustic alkalies, acids.

*Synergists*: Alcohol, ether, bromides, cocaine, narcotics.

*Allied Native Products*:

These are mostly used for smoking, beverages, or electuaries, etc.

1. *Bhang* (*Sidhee*, *Subjee*, *Siddhi*).—Consists of the dried coarsely broken leaves and fruit (dark green), resembles *ganja* in odor and taste;

**MORACEÆ.**

used by natives in their sweet-meat (*majoon*), also smoked with or without tobacco; its cold infusion (tea) as an intoxicant.

2. *Churrus, Churras, Charas*.—This is the resin (practically the active constituent) which exudes spontaneously from the entire plant in minute drops. It is collected in several different ways: 1. By men wearing leather suits brushing forcibly against growing plants, when resin adheres and is afterward scraped off. 2. By rubbing green portions between the hands and then scraping off adhering resin. 3. By frequent stirring around that put away in barns to cure, the resin is caused to rise in the form of dust, and to deposit upon the roof and sides of the building, from which it can afterward be collected. Owing to this being more or less impure it is not used in medicine, but solely smoked in pipes.

3. *Hashish (Hasish, Haschisch, Hasash, Hasheesh—Majoom)*.—The Arabic name for hemp, signifying "green intoxicating liquor" fr. Heb. *shesh*, to be joyous. This may consist of the dried tops collected before seeds ripen, thereby resembling *ganga, gunjah*, but usually is more complex, being prepared by heating tender leaves and tops 4 parts, butter 3, water 4, until latter dissipated, straining, washing twice the greenish extract with water; prepare a syrup by boiling sugar 16 parts, water 32, + little milk, add to this the greenish extract, heat, mystify by adding seeds of either stramonium or nux vomica; in Bengal a little rose oil, musk, cardamom, or opium is often incorporated; boil half an hour, let solidify, cut into cakes. It is often formed into cakes with the resinous extract, and as such is preferred by the Russians.

4. *Hemp Seed (Cannabis Semen)*.—These are achenes 3 Mm. ( $\frac{1}{8}$ ') long, roundish, smooth, greenish, taste sweet, oily. Used for birds chiefly, but, owing to the fixed oil, an emulsion becomes a valuable demulcent and anodyne; contain proteid 22–24 p. c., fixed oil 28–36 p. c., suitable for painting, varnishing, etc.

5. *Hemp Oil*.—A greenish fixed oil, lighter and brownish on exposure; odor hemp-like, taste mild. Demulcent, protective; chiefly extracted for its possible use in the domestic arts; neither this nor seeds possess narcotic properties.

6. *Hemp Fibre*.—Used for cordage, sacking, sail cloths, clothing, etc. The colder climates produce the best fibres, and the tropics grow that which is most medicinal and intoxicating. Russia produces most of the hemp fibre, but Italy the best; that grown in the United States and India is inferior to that of the other two countries.

*Allied Plant:*

1. *Cannabis americana* (*C. sativa*), *American Hemp*.—The flowering tops or whole flowering plant, official 1870–1890. S. United States. Plant same as official, has escaped cultivation from native country, and has slight variations due to this climate, etc.; properties are weaker, owing to colder temperature than in Hindustan.

RECAPITULATION No. 2.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Dose.
<i>Convolvulaceæ</i> : 1. <i>Convolvularia</i> . 2. <i>Convolvularia</i> .	<i>Convolvularia majalis</i> .	The dried rhizome and roots.	U. States, Europe, Asia.	Convallamarin, convallarin, resin.	Fluidextract.	Heart-tonic, emetic, purgative, diuretic, stimulant.	Dropsy, heart disease, palpitation, pneumonia, typhoid.	Grains, 2-10 (13-6 Gm.).
1. <i>Colchicum Cormus</i> . 2. <i>Colchicum Corm.</i>	<i>Colchicum autumnale</i> .	The dried corm.	C. and S. Europe.	Colchicine, colchicine, starch, colchicoresin, fixed oil, sugar.	Extract.	Alterative, cathartic, emetic, sedative, diuretic, diaphoretic.	Gout, rheumatism, skin affections, prurigo, urticaria, neuralgia.	2-8 (13-5 Gm.).
1. <i>Colchicum Semen</i> . 2. <i>Colchicum Seed</i> .		The seed.	N. Africa.		Fluidextr., tinct., wine.			1-5 (06-3 Gm.).
<i>Smilacaceæ</i> : 1. <i>Sarsaparilla</i> . 2. <i>Sarsaparilla</i> .	<i>Smilax medica</i> , <i>ornata</i> , <i>papyracea</i> , <i>officinalis</i> .	The dried root.	Trop. America, Mexico.	Parillin, saponin, volatile oil, resin, starch, Ca oxalate, coloring.	Fluidextr., compd. extr., compd. fluid-extract.	Alterative, diuretic, diaphoretic, tonic.	Blood purifier in scrofula, skin diseases, syphills, abscesses, ulcers.	30-120 (2-8 Gm.).
<i>Zingiberaceæ</i> : 1. <i>Cardamomum</i> . 2. <i>Cardamom</i> .	<i>Elettaria repens</i> .	The dried nearly ripe fruit.	Malabar, India.	Volatile oil, fixed oil, starch, salts.	Tinct., tinct. co., extr. colocy. co., tr. gent. co., pulv. arom., tr. rhei.	Carminative, stimulant, aromatic, condiment.	As adjuvant or corrective to cordials, tonics, purgatives, flavors.	5-15 (3-1 Gm.).
1. <i>Zingiber</i> . 2. <i>Ginger</i> .	<i>Zingiber officinale</i> .	The dried rhizome.	India, Africa, Hindustan.	Volatile oil, gingerol, resin, starch, mucilage.	Fluidextr., syrup, oleoresin, tinct., pulv. arom., pulv. rhei comp.	Carminative, stimulant, sternutatory, rubefacient, anodyne, stagogue.	Dyspepsia, diarrhoea, cholera, bronchitis, rheumatism, toothache, headache, colic.	5-20 (3-1.3 Gm.).
<i>Orchidaceæ</i> : 1. <i>Cypripedium</i> . 2. <i>Cypripedium</i> .	<i>Cypripedium</i> : <i>pubescens</i> , <i>parviflorum</i> . <i>Vanilla planifolia</i> .	The dried rhizome and roots.	N. America.	Volatile oil, fixed oil, acid, resin, tannin.	Fluidextract.	Antispasmodic, diaphoretic, stimulant.	Chorea, hysteria, epilepsy, hypochondriasis, neuralgia, insomnia.	15-30 (1-2 Gm.).
1. <i>Vanilla</i> . 2. <i>Vanilla</i> .		The cured fruit.	E. Mexico.	Vanillin, fixed oil, resin, sugar, mucilage.	Tincture.	Carminative, stimulant, aphrodisiac, irritant.	Hysteria, flavoring agent.	5-30 (3-2 Gm.).
<i>Piperaceæ</i> : 1. <i>Cubeba</i> . 2. <i>Cubeb</i> .	<i>Piper Cubeba</i> .	The dried unripe fruit.	Java, Sumatra, Borneo, W. Indies.	Volatile oil, resin, fat, cubebin, cubebic acid.	Fluidextr., oleo-resin, troches, oil.	Diuretic, stimulant, carminative, irritant.	Gonorrhoea, cystitis, bronchitis, catarrh, vesical irritability.	15-60 (1-4 Gm.).
1. <i>Piper</i> . 2. <i>Pepper</i> .	<i>Piper nigrum</i> .	The dried unripe fruit.	S. India, Malabar.	Piperine, volatile oil, piperidine, chavicol, fat.	Oleoresin, piperine.	Stimulant, tonic, febrifuge, irritant, antipyretic.	Intermittents, rheumatism, colic, headache, indigestion, gleet.	5-20 (3-1.3 Gm.).

1. Matico. 2. Matico.	<i>Piper augustifolium</i> .	The leaves.	Tropical America.	Volatile oil, arbutinic acid, resin, bitter principle, tannin, mucilage.	Stimulant, tonic, styptic, diuretic, aphrodisiac, vulvovaginal catarrh.	15-60 (1-4 Gm.).
<i>Sedlaceae</i> : 1. Salicinum. 2. Salicin.	<i>Salix</i> and <i>Populus</i> species.	A glucoside.	Europe, N. America.	$C_{15}H_{16}O_7$ .	Bitter, tonic, antiperiodic, antipyretic, antiseptic, antiferment.	10-80 (5-2 Gm.).
<i>Betulaceae</i> : 1. Oleum Betule. 2. Volatile oil of Betula.	<i>Betula lenta</i> .	The volatile oil.	N. America.		Rheumatism, intermit- tent, coryza, neuralgia, diabetes, eczema, cancers, relieves pain.	Minims. 1-10 (0.6-6 Cc.).
<i>Fagaceae (Cupuliferæ)</i> : 1. Quercus. 2. White Oak.	<i>Quercus alba</i> .	The dried bark.	N. America.	Tannin, oak-red, quercin, resin, pectin.	Stimulant, diuretic, emmenagogue.	Grains. 15-60 (1-4 Gm.).
1. Gallia. 2. Nutgall.	<i>Quercus infectoria</i> .	The excre- scence.	Mediterranean Basin.	Tannin, gallic acid, resin, starch.	Astringent, tonic, hæmostatic.	5-30 (3-2 Gm.).
<i>Ulmaceae</i> : 1. Ulmus. 2. Elm.	<i>Ulmus fulva</i> .	The dried inner bark.	N. America.	Mucilage, starch, tannin, bitter principle.	Diarrhoea, gleet, relaxed membranes, sore mouth, antidote to alkaloidal poisoning.	120-240 (8-15 Gm.).
<i>Moraceae</i> : 1. Ficus. 2. Fig. 1. Humulus. 2. Hops. 1. Lupulinum. 2. Lupulin.	<i>Ficus Carica</i> . <i>Humulus Lupulus</i> .	The partially dried fruit. The dried strobiles. The glandular fruit trichomes.	W. Asia. N. Temperate zone.	Grape-sugar, gum, fat, salts. Vol. oil, resin, asparagin, choline, tannin, Vol. oil, choline, resin, lupamaric acid.	Nutritious, demul- cent, laxative. Tonic, sedative, anodyne, hypnotic.	Habitual constipation, Ad libitum. 30-60 (2-4 Gm.). 5-15 (3-1 Gm.).
1. Cannabis Indica. 2. Indian Cannabis.	<i>Cannabis sativa</i> .	The dried pistillate flowering tops.	Asia, N. India.	Cannabin, oxycannabin, tetrahydrocannabin, cannabindion, choline.	Anodyne, nervine, sudorific, narcotic, aphrodisiac.	1-5 (0.6-3 Gm.).



## 21. SANTALACEÆ. Sandalwood Family.

San-ta-la'se-e. L. *Santal-um* + aceæ. Pers. name *sandul*, useful, or fr. L. *sandal*, Gr. *σανταλον*, the classic name for Skt. *chandana*—*chand*, shine. L. *candere*, to shine—i. e., polished woody surface shines. Herbs, shrubs, trees. Distinguished by leaves entire, exstipulate; calyx 3–6-lobed, coherent with 1-celled ovary, superior, valvate; flowers perfect, greenish, petals none, stamens 3–9, ovules 1–4, suspended; fruit 1-seeded, drupe or nut; temperate climates, tropics; astringent, seed oily, fruit edible.

Genus: 1. *Santalum*.

## SANTALUM ALBUM. WHITE SANDAL.

*Oleum Santali*. Oil of Santal, official.

*Santalum album*, Linné. } A volatile oil, distilled from the wood.

*Habitat*. S. India, E. Indian Islands, Malabar, Macassar (mountains); cultivated.

*Syn*. White Sandal Wood (young wood), White Saunders, Saunders, Almug, Yellow Sandal (old wood), Oil of Sandal Wood, *Oleum Ligni Santali*, *Oleum Santali Flavi*; Fr. *Essence de Santal*, *Santal Citrin* (huile volatile); Ger. *Sandelöl*, *Santelöl*, *Ostendisches Sandelholzöl*.

*San'ta-lum*. L. see etymology, above, of *Santalaceæ*.

*Al'bum*. L. *albus*, white or light—i. e., the color of the sapwood.

PLANT.—Small tree 6–9 M. (20–30°) high, bark grayish-brown; leaves oval, smooth, glaucous beneath; flowers small, numerous cymes; odorless, color variable, violet-pink, red, yellow. Wood, yellow inside (heartwood), white outside (sapwood). The heartwood only should be used, which natively is obtained by felling trees of .3 M. (12') diameter, hacking off sapwood, or allowing these trunks to remain on the ground until sapwood is eaten away by ants, thereby becoming 10–20 Cm. (4–8') thick. This, when rubbed, rasped, or heated, gives pleasant roseate odor.

CONSTITUENTS.—Volatile oil 2–5 p. c., resin, tannin.

*Oleum Santali*. Oil of Santal.—A pale yellowish, thickish liquid, peculiar, aromatic odor, pungent, spicy taste, sp. gr. 0.975, soluble in alcohol, 5 volumes 70 p. c. alcohol; contains sesquiterpene, aldehyde—santalal,  $C_{15}H_{21}O$ , and an alcohol—santalol (chief constituent),  $C_{15}H_{25}O$ , 90 p. c., both being decomposed by distillation over  $P_2O_5$ ; santalal giving  $C_{15}H_{22}$ , santalol yielding santalene,  $C_{15}H_{24}$ . *Tests*: 1. Levogyrate (dis. from Australian, sp. gr. 0.953, and W. Indian sandal-wood oil, sp. gr. 0.965, both being dextrogyrate). 2. Oil 1 Cc. + 70 p. c. alcohol 10 Cc. should yield clear solution (abs. cedar-wood oil, castor oil, other fatty oils). 3. In a dish saturate strip of filter paper folded as a taper, upon ignition invert over it a beaker with inner surface moistened with distilled water, which absorbs a portion of the products of combustion, rinse beaker with little distilled water, filter; the filtrate should not be turbid with few

**SANTALACEÆ.**

drops silver nitrate T. S. (abs. of chloroform as chlorinated products).  
*Assay* : For santalol—Add 10 Cc. oil to an acetylation flask, + 10 Cc. acetic acid anhydride, + 2 Gm. anhydrous sodium acetate, boil  $1\frac{1}{2}$  hours, cool, wash acetylated oil with distilled water, then with sodium hydroxide T. S., until slightly alkaline to phenolphthalein T. S., dry with aid of fused calcium chloride, filter. Transfer to a tared 100 Cc. flask 3 Cc. dry acetylated oil, note weight, add 50 Cc.  $\frac{N}{2}$  alcoholic potassium hydroxide V. S., connect with reflux condenser, boil 1 hour, cool, titrate residual alkali with  $\frac{N}{2}$  sulphuric acid V. S., using phenolphthalein T. S. indicator; multiply difference in Cc. of two V. S. by 11.026,

FIG. 94.

*Santalum album* : flowering branch; also flower and fruit, enlarged.

divide by weight of dry acetylated oil taken, less the above difference multiplied by 0.021; quotient = p. c. of santalol in the oil. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{m}5\text{--}20$  (.3–1.3 Cc.).

**ADULTERATIONS.**—Castor oil, other fixed oils, chloroform, gurjun balsam oil, volatile oil of copaiba and of cedar-wood, made from lead-pencil chips by distillation, etc. While that distilled in India and Germany is a good article, that made in England is considered the best and purest, hence is more expensive.

**PREPARATIONS.**—(Unoff.) **WOOD** : *Fluidextract*, dose,  $\text{ʒss}\text{--}2$  (2–8 Cc.) **OIL** : *Emulsion*. *Wafers*. *Pills*. *Capsules*. *Massa*.

PROPERTIES.—Astringent, stimulant, diuretic, disinfectant, expectorant. Excreted by bronchial and genito-urinary mucous membranes, stimulating and disinfecting secretions of both.

USES.—Bronchitis, gonorrhœa, chronic and subacute inflammations of mucous membranes, cystitis, pyelitis, chronic diarrhœa. Very much like copaiba and cubeb in action, and should be continued some time after discharges have ceased. Extensively used in perfumery. The wood is used natively for fevers, indigestion, palpitation, inflammations, skin diseases; also as incense in Chinese temples, and by cabinet-makers for caskets, jewel boxes, and as a perfume; have 3 varieties: 1. Malabar, 2. Macassar, 3. W. Indian.

*Allied Plants:*

1. *Santalum Freycinetia'num* and *S. pyrula'rium* of the Sandwich Islands. *S. Ya'si* of the Feejee Islands. *S. austro-caledon'icum* of New Caledonia. All 3 furnish oil of good quality.

2. *Venezuela Sandal Wood*.—Rutaceæ. This supplies the market with W. Indian sandalwood oil.

## 22. ARISTOLOCHACEÆ. Birthwort Family.

Ar-is-to-lo-ki-a'se-e. L. *Aristolochi-a* + aceæ, fr. Gr. *ἀριστος*, best, + *λῳσία*, child-birth—i. e., once thought to ease labor. Low herbs or climbing shrubs. Distinguished by abounding in bitter principles and volatile oils; flowers perfect, dull-colored; calyx conspicuous, lurid, tubular, coherent with 6-celled ovary, forming a many-seeded, 6-celled capsule or berry fruit; petals none; stamens 6–12, epigynous; leaves cordate, entire, petioled; temperate climates; tonic, stimulant, acrid, cures snake bites.

Genus: 1. *Aristolochia*.

## SERPENTARIA. SERPENTARIA.

*Aristolochia* { *Serpentaria*, Linné, } The dried rhizome and roots.  
                  { *reticulata*, Nuttall. }

*Habitat.* United States, in hilly woods: 1. In Middle, Southern, and Western States east of Mississippi River. 2. S. W. States, Louisiana to Texas, called Red River or Texas Snakeroot.

*Syn.* Virginia Snakeroot, Snakeroot or Snakeweed, Sangrel, Snagrel, Sangree Root, Pelican Flower, Birthwort, Thick Birthwort; Br. *Serpentariæ Rhizoma* (radix), *Serpentary Rhizome*; Fr. *Coulevrée de Virginie*, *Serpentaire* (*Vipérine*) de Virginie; Ger. *Virginische Schlangenzwurzel*.

*Ar-is-to-lo'chi-a.* L. see etymology, above, of *Aristolochiaceæ*.

*Ser-pen-ta'ri-a.* L. *serpen(t)s*, serpent—i. e., having power of rendering harmless serpent bites.

*Re-tic-u-la'ta.* L. *reticulatus*, fr. *rete*, a net—i. e., leaves strongly netted.

*Virginia Snakeroot.* Root from Virginia, once thought a valuable antidote for snake bites.

PLANTS.—Perennial herbs; stems sometimes several, slender, erect, zigzag, jointed, .3 M. (1°) high, purple below; leaves cordate, ovate, 5–7.5 Cm. (2–3') long, pale green, entire; flowers June–July, few,

## ARISTOLOCHIACEÆ.

purple, due to the calyx, which is tubular, inflated at both ends and bent like letter S; corolla absent. *A. Serpentina* has leaves petiolate, pointed, thin, pubescent. *A. reticulata* has leaves subsessile, obtuse, thickish, reticulate, hairy. RHIZOME (*Aristolochia Serpentina*—*Virginia Serpentina*), of oblique growth, 2 Cm. ( $\frac{4}{5}$ ') long, 2 Mm. ( $\frac{1}{12}$ ') thick, yellowish-brown, slightly annulate, upper surface with numerous stem-scars or stem-bases, lower surface bearing a dense tress of thin, branching roots, 4–7 Cm. ( $1\frac{1}{2}$ –3') long, fracture short, yellowish-brown, xylem in the roots 5-rayed; odor camphoraceous; taste bitter, aromatic; (*Aristolochia reticulata*—*Texas Serpentina*), rhizome twice as large as that of *Virginia Serpentina*, grayish-brown, roots fewer, less interlacing, thicker. Solvents: alcohol; diluted alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—*Spigelia marylandica*; not aromatic, not bitter, has no projecting stem-remnants, has in the wood indistinct medullary rays. *Hydrastis canadensis*; yellow internally, no odor, upright growth. *Aristolochia Serpentina* var. *hastata*, S. Ca., La.; leaves auriculate, stems smaller, more slender and simple. *Cypripedium hirsutum* (*pubescens*) and *C. parviflorum*; scars circular, roots coarse. *Polemonium reptans* and *Panax quinquefolium*, *Ginseng*; the former resembles closely *serpentina*, but is nearly white.

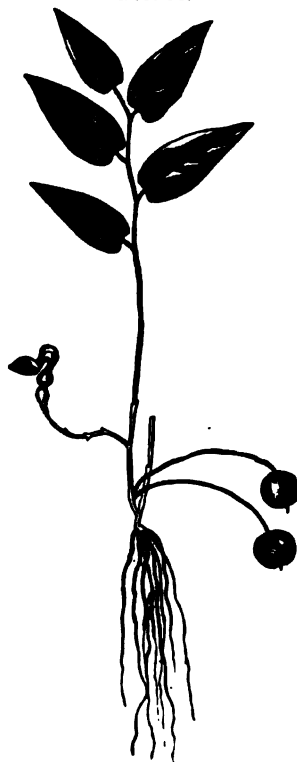
CONSTITUENTS.—Volatile oil 0.5–1 p. c., Aristolochine, Aristolochin (clematitin, bitter principle), Serpentin (bitter principle, poisonous), resin 5 p. c., tannin, starch, sugar, mucilage, albumin, ash 11 p. c.

Volatile Oil.—Obtained by distilling with water; contains a terpene (probably pinene),  $C_{10}H_{16}$ , also borneol ester,  $C_{15}H_{26}O$ , 60 p. c., and a green or bluish-green fraction.

Aristolochine,  $C_{32}H_{22}NO_{13}$ .—Obtained by precipitating decoction with lead acetate, exhausting precipitate with hot alcohol, evaporating, dissolving bitter principle (alkaloid) by shaking with water; it is yellow, amorphous or in needles; soluble in water, alcohol, ether, precipitated by tannin.

PREPARATIONS.—1. *Fluidextractum Serpentariae*. Fluidextract of *Serpentina*. (Syn., *Extractum Serpentariae Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Serpentinaire*; Ger. *Flüssiges Schlangenwurz(el)-extrakt*.)

FIG. 95.

*Aristolochia Serpentina*.

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose, ℥v-30 (.3-2 Cc.).

2. *Tinctura Serpentariæ*. Tincture of *Serpentaria*. (Syn., Tincture of Virginia Snake-root; Fr. Teinture de Serpentaire; Ger. Schlangenwurzeltinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol 65 p. c., q. s. 100 Cc. Dose, ʒss-2 (2-8 Cc.).

3. *Tinctura Cinchonæ Composita*, 2 p. c.

*Unoff. Preps.*: *Infusum Serpentariæ* (Br.), 5 p. c., dose, ʒj-2 (30-60

FIG. 96.



Serpentaria: rhizome with roots.



Rhizome: transverse section.

Cc.). *Liquor Serpentariæ Concentratus* (Br.), 50 p. c., dose, ʒss-2 (2-8 Cc.).

**PROPERTIES.**—Stimulant, tonic, diaphoretic, diuretic, emmenagogue, aphrodisiac, antiperiodic; like calumba promotes appetite, digestion, increases bronchial and intestinal secretions, heart action, mental exhilaration. Large doses are irritant, causing vomiting, vertigo, colic, purging, tenesmus.

**USES.**—As a stimulating expectorant in typhoid pneumonia, exanthematous diseases, intermittents, dyspepsia, typhoid pneumonia, diphtheria. Fluidextract good locally against poison-oak rash.

*Allied Plant*:

1. *As'arum canadense*, *Wild Ginger*.—The rhizome (root), official 1820-1880. North America. Small plant with dividing stem; leaves 2, reniform; flowers brownish-purple, woolly; fruit capsule, 6-celled; rhizome 10 Cm. (4') long, 3 Mm. ( $\frac{1}{8}$ ') thick, square or 2-edged, brownish, aromatic, pungent, bitterish; contains volatile oil 1.5-3.5 p. c., resin, asarin. Used as stimulant, carminative, tonic, diaphoretic, diuretic, for whooping-cough, colic, febrile affections; in infusion, tincture, syrup. Dose, gr. 30 (2 Gm.).

### 23. POLYGONACEÆ. Buckwheat Family.

Pol-i-go-na'se-e. L. *Polygon-um* + aceæ, fr. Gr. πολλή, many, + γόνη, knee, joint—i. e., from stem's numerous joints. Herbs or shrubs.

## POLYGONACEÆ.

Distinguished by acrid, astringent, purgative properties, stems composed of many swollen joints, with ocreate stipules above each; flowers perfect, on jointed pedicels; calyx 3–6, greenish or petaloid, inferior; ovary 1-celled, superior, styles and stigmas 2–3; stamens 6–9; fruit 3-angled, seed solitary; temperate climates; astringent, purgative; contain oxalic acid and oxalates.

Genus: 1. *Rheum*.

## RHEUM. RHUBARB.

<b>Rheum</b>	{	<i>officinale</i> , Baillon, <i>palmatum</i> , Linné, and var. <i>tanguticum</i> , Maximowicz, and probably other species.	}	The dried rhizome, grown in China, Thibet, deprived of most of the bark and care- fully dried.
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*Habitat.* W. and C. China, Thibet, Chinese Tartary.

*Syn.* Turkey or China Rhubarb: Br. Rhei Radix; Fr. Rhabarbarum, Rhubarbe de Chine; Ger. Radix Rhei, Rhabarberwurzel.

*Rheum.* L. Rha, the river Volga, upon whose banks it grows and was first found, fr. Gr. *ῥῆον, ῥεῖν*, to flow—*i. e.*, it causes purgation.

*Of-fi-ci-na'le.* L. *officina*, workshop; *opus*, work, + *facere*, to do—*i. e.*, used in or belonging to the shop or store.

*Pal-ma'tum.* L. *palmatus*, fr. *palm*, palm of the hand—*i. e.*, the much divided leaves.

*Tan-gut'i-cum.* L. pertaining to Tangut, district of Kansu, in Northwestern China—*i. e.*, plant's habitat.

*Rhubarb*, contraction of *rheubarbarum*—*rheum* + *barbarum*—*i. e.*, barbarian plant from the Rha (Volga), whence name *rha Ponticum*—*Pontic-rha*, *R. rha-ponticum*, fr. Pontic or Euxine Sea.

**PLANTS.**—Large, compact, perennial herbs, resembling our garden rhubarb, only larger; stems after a few years, 10–15 Cm. (4–6') thick, persistent through winters, many branches, 25–37.5 Cm. (10–15') long, 7.5–15 Cm. (3–6') thick, dark brown coat from withered ocreas and leaf-bases, inside fleshy, semi-pulpy, juice yellow; leaves very large, petioles .3–.5 M. (12–18') long, 2.5–4 Cm. (1–1½') thick, blade .6–1.3 M. (2–4') long and wide, palmately-veined, 5–7-lobed; flowering branches (stems) 1.5–3 M. (5–10') high, hollow, thick, green, smoothish; flowers May–June, 6 Mm. (¼') long, in clusters of 7–10, catkin-like compound panicles, greenish-white; fruit August, in small clusters, 12 Mm. (½') long, 6 Mm. (¼') broad, triangular, crimson-red. **RHIZOME**, in subcylindrical, barrel-shaped, conical, plano-convex, or irregularly formed pieces, frequently with a large perforation, hard, moderately heavy, 5–15 Cm. (2–6') long, 4–8 Cm. (1½–3') thick, mottled with alternating striæ of light brown parenchyma cells and dark brown medullary rays, occasionally with reddish-brown cork patches and small, radiate scars of fibrovascular tissue, smooth, sometimes covered with brownish-yellow powder, fracture granular, marbled; odor characteristic; taste bitter, astringent, gritty when chewed; powder orange-yellow, red with alkalis, containing rosette-shaped crystals of calcium oxalate and spherical starch grains, single or 2–4-compound. Pieces that are porous, or of a mucilaginous taste, or of a dark brown

interior should be rejected. *Solvents* : alcohol ; water. Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—Irrespective of variety, rhubarb should be moderately heavy, compact, bright color, brittle, broken edges with fresh appearance, red and yellow veins intermingled with white, decidedly aromatic odor, bitter, astringent, slightly gritty, not mucilaginous, staining saliva yellow ; powder bright yellow or reddish-brown. To this turmeric sometimes is added, and also rubbed over unsightly pieces—recognized by its starch-grains, also by adding to gr. 5 (.3 Gm.) of

FIG. 97.



*Rheum officinale*: n, pistils and stigmas; d, nectar tubes.

suspected rhubarb a few drops of chloroform on white paper : Chinese will slightly stain paper ; European or dark-colored Chinese gives deep yellow stain ; now add a few grains of borax + a drop of hydrochloric acid, when if pure rhubarb the stain will not be changed, if turmeric present get a distinct red.

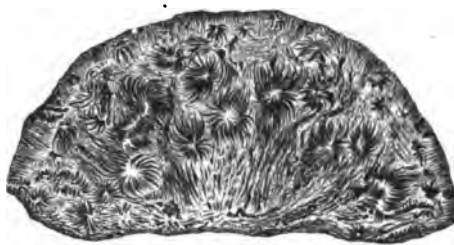
**Commercial.**—Rhubarb grows wild and is cultivated extensively in Chinese Empire. A number of species furnish the official product, but chiefly *R. officinale*, *R. palmatum*, and var. *tanguticum*. In Tartary the rhizome is dug in the spring and autumn, in China during September–October, from plants 8–10 years old ; the roots and corky layer are removed, rhizomes divided into segments (to facilitate drying).

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bored with holes, threaded on strings, and suspended in the shade or under cover to dry by circulating air, the curing lasting sometimes a year, thereby losing 80 p. c.; the larger roots often are included, but owing to inferiority are recognized commercially as "tails." When dried by sun, ovens, or stoves the rhizome is not so firm, and usually that by artificial heat, "high dried," has broad ridges and blackish grooves, with heavy, disagreeable, empyreumatic odor. The plants flourish best in light, sandy soil, and while most of our supply comes from Hankow, on the Upper Yang-tse, that from Hsining (Tze-chuen and Shensi products) commands the highest price. There are 3 commercial varieties:

1. *Russian, Crown (R. palmatum)*.—This is no longer on the market; it consisted of the best rhubarb trimmed to beneath the cambium, having a very large conical hole for easy inspection; it came from Chinese Tartary via Siberia. At Kiachta it was rigorously inspected, the refuse being burned and the reserved pieces sewed in linen sacks, covered with hide, and then sent to St. Petersburg. Also known as Turkey rhubarb, from the fact of the Turkish ports once supplying it, whither it was brought from Tartary by caravans through Persia and Anatolia.

FIG. 98.



Russian rhubarb: transverse section.

2. *Chinese, E. Indian (R. officinale, R. palmatum, var. tanguticum, etc.)*.—This is our official rhizome, has inner bark present, also sometimes patches of rough corky layer, twine fibres; color less bright and odor less aromatic than Russian. It flourishes best elevated 2,400–3,000 M. (8,000–10,000°) in the Himalaya and other mountains, on the shady side of damp ravines, with northern exposure. Exported mainly from Canton—hence name "Canton rhubarb," sometimes via India.

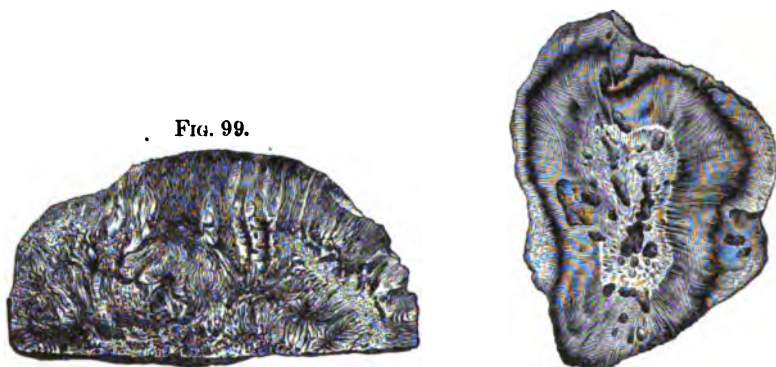
3. *European (R. palmatum, R. rhaponticum, R. compactum, R. undulatum, R. Emodi +)*.—Cultivated in England, France, Austria (Moravia). The roots are cut to resemble Chinese, but differ in having outside nearly or entirely without white meshes, the medullary rays interrupted, narrow, nearly straight, color paler, odor weaker, taste less gritty, more mucilaginous; not much imported. All kinds approximate two shapes, *round* and *flat*, by which often they are designated, and are subject to insect-attack, which is prevented best by keeping in containers having a tuft of cotton saturated with chloroform.

**CONSTITUENTS.**—Chrysophanic acid 5 p. c., Methyl-chrysophanic acid, Emodin, Rhabarberon, Rhein, Glucoside, Rheotannic acid, and anhydrides, gallic acid, phenolic body, cathartic acid, resins (phæoretin, erythreoretin, aporetin), oxalic acid and oxalates, starch, ash 12–14



p. c. ; if very inferior = 35–45 p. c. For many years the virtues were believed to reside in cathartic acid and resins, but Tschirch disclaims the presence of the latter, and claims that the cathartic effect results entirely from the anthraglucosides (chrysophanic acid, emodin, rhein) and derivatives; that besides the anthraglucosides there exist also tannoglucosides, both classes being of primary formation in the plant, and readily decomposed and converted into secondary products, even during treatment with ordinary solvents.

FIG. 100.



Chinese rhubarb: transverse section.

European rhubarb: transverse section.

**Chrysophanic Acid** (*Dioxymethylantraquinone*),  $C_{15}H_8O_2(OH)_2$ .—Obtained by hydrolyzation, washing with water, dissolving out emodin with diluted solution of sodium carbonate; generally contains some methyl-chrysophanic acid, but may be purified by crystallization from alcohol, or from glacial acetic acid, when it occurs in small yellow shining scales, melting at  $186^\circ C.$  ( $367^\circ F.$ ); heating with strong hydriodic acid transforms it into *chrysophanhydroanthrone*— $C_{15}H_{10}O_4 + 4HI = C_{15}H_{12}O_2 + H_2O + 4I$ .

**Emodin, Rhubarb-emodin** (*Trioxymethylantraquinone*),  $C_{15}H_7O_2(OH)_3$ .—May be obtained by dissolving it out from crude chrysophanic acid either by diluted solution of sodium carbonate or hot benzene; it also crystallizes from hot diluted acetic acid, and occurs in orange prisms, turning deep red with alkalis.

**Rhein** (*Tetraoxymethylantraquinone*),  $C_{15}H_{10}O_6$  or  $C_{15}H_8O_6$ .—Being sparingly soluble in hot acetic acid, alcohol, benzene, or toluene, renders it easily separated from the preceding constituents. Tschirch concludes, as this only yields a diacetyl derivative, it cannot be regarded as tetraoxymethylantraquinone, as stated by Hesse.

**Rhabarberon**,  $C_{15}H_{10}O_5$ .—Is soluble in hot alcohol, sparingly in alcohol, insoluble in water; forms small yellow scales, melting at  $212^\circ C.$  ( $414^\circ F.$ ).

**Glucoside**.—By hydrolyzation yields chrysophanic acid and glucose, melts at  $208^\circ C.$  ( $407^\circ F.$ ), gives upon hydrolysis emodin and rhein.

**Rheotannic acid** (*Tannoid, rhubarb-red*),  $C_{26}H_{26}O_{14}$ .—Yellowish-

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brown powder, or dark brown scales, soluble in alcohol, glycerin, acetone, ethyl acetate, 3 parts water, insoluble in chloroform, ether, petroleum ether, hydrolysis with acids yields gallic acid and a phenolic body, which is white, crystalline, softening at 174° C. (346° F.).

**Resins.**—These are coloring principles intermediate between resin and extractive matter; *phæoretin* (brown resin), soluble in alcohol, and obtained by washing alcoholic extract with water, dissolving residue in a little alcohol, adding ether; the precipitate contains phæoretin, aporetin, and resinous matter; the liquid concentrated, gives chrysophanic acid; *erythroretin*,  $C_{38}H_{36}O_{14}$  (red resin), is contained in the mother-liquor—claimed to be a mixture of chrysophanic acid, emodin, and rheïn; it is tasteless, and soluble in alcohol; *aporetin* (black resin), insoluble in alcohol, with alkalies yields brown solution, with nitric acid is oxidized into oxalic and chrysammic acids.

**Oxalates, Calcium, etc.**—Causes grittiness—present to the extent of 2–40 p. c.

**PREPARATIONS.**—1. *Fluidextractum Rhei*. Fluidextract of Rhubarb. (Syn., Extractum Rhei Fluidum, U. S. P. 1890; Fr. Extrait liquide de Rhubarbe; Ger. Flüssiges Rhabarberextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose, ℥v–30 (.3–2 Cc.).

**Preps.:** 1. *Extractum Rhei*. Extract of Rhubarb. (Syn., Extractum Rhei Alcoholicum; Fr. Extrait de Rhubarbe; Ger. Rhabarberextrakt.)

**Manufacture:** Evaporate cautiously to a pilular consistence fluidextract of rhubarb 100 Cc. Dose, gr. 3–10 (.2–.6 Gm.).

2. *Mistura Rhei et Sodæ*. Mixture of Rhubarb and Soda. (Syn., Fr. Potion à la Rhubarbe alcaline; Ger. Alkalische Rhabarbermixture.)

**Manufacture:** Dissolve sodium bicarbonate 3.5 Gm. in water 40 Cc., add fluidextract of rhubarb 1.5, fluidextract of ipecac .3, glycerin 35, spirit of peppermint 3.5, water q. s. 100 Cc. Dose, ʒj–16 (4–60 Cc.).

3. *Syrupus Rhei*. Syrup of Rhubarb. (Syn., Fr. Sirop de Rhubarbe; Ger. Rhabarbersirup (saft).)

**Manufacture:** Fluidextract of Rhubarb 10 Cc., spirit of cinnamon .4, potassium carbonate 1 Gm., water 5 Cc., syrup q. s. 100 Cc. Dose, ʒj–4 (4–15 Cc.).

2. *Pilulæ Rhei Compositæ*. Compound Pills of Rhubarb. (Syn., Fr. Pilules de Rhubarbe composées; Ger. Rhabarber und Aloepillen.)

**Manufacture:** Rhubarb 13 Gm., purified aloes 10, myrrh 6, oil of peppermint .5, water q. s. 100 pills. Dose, 1–5 pills.

3. *Pulvis Rhei Compositus*. Compound Powder of Rhubarb. (Syn., Gregory's Powder, Powder Magnesia and Rhubarb, Pulvis (Infantum) Antacidus; Fr. Poudre de Rhubarbe composée; Ger. Pulvis Magnesiæ cum Rheo, Kinderpulver.)

**Manufacture:** 25 p. c. Rhubarb 25 Gm., magnesium oxide 65, ginger 10. Dose, ʒss–1 (2–4 Gm.).

4. *Tinctura Rhei*. Tincture of Rhubarb. (Syn., Fr. Teinture de Rhubarbe; Ger. Rhabarbertinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. + cardamom 4, with glycerin 10 Cc., alcohol 50, water 40, finishing with alcohol 55 p. c., q. s. 100 Cc. Dose, ʒss–4 (2–15 Cc.).

5. *Tinctura Rhei Aromatica*. Aromatic Tincture of Rhubarb. (Syn., Fr. Teinture de Rhubarbe aromatique; Ger. Aromatische Rhabarbertinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. + saigon cinnamon 4, cloves 4, nutmeg 2, with glycerin 10 Cc., alcohol 50, water 40, finishing with alcohol 55 p. c., q. s. 100 Cc. Dose, ʒss–4 (2–15 Cc.).

*Prep.*: 1. *Syrupus Rhei Aromaticus*. Aromatic Syrup of Rhubarb. (Syn., Spiced Syrup of Rhubarb; Fr. Sirop de Rhubarbe aromatique; Ger. Gewürtzer Rhabarbersirup (saft).)

*Manufacture*: Dissolve potassium carbonate .1 Gm. in aromatic tincture of rhubarb 15 Cc., filter, add syrup q. s. 100 Cc. Dose, for a child with diarrhoea, ʒj–2 (4–8 Cc.).

*Unoff. Preps.*: *Sweet Tincture*, 10 p. c., dose, ʒij–4 (8–15 Cc.).

*Pills*, 3 gr., dose, 1–5. *Wine (Vinum)*, 10 p. c., dose, ʒj–4 (4–15 Cc.).

*Aromatic Fluidextract*, dose, ℥xv–60 (1–4 Cc.). *Infusum Rhei* (Br.),

5 p. c., dose, ʒiv–8 (15–30 Cc.). *Liquor Rhei Concentratus* (Br.), 50

p. c., dose, ʒss–1 (2–4 Cc.). *Torrefied Rhubarb*.—By roasting, the

cathartic principle is volatilized and the full astringency left behind; long boiling will effect the same result.

**PROPERTIES**.—Aperient, purgative, astringent, stomachic, tonic. It increases saliva, gastric juice, bile, peristalsis, vascularity, and absorption. The cathartic effect comes first (4–8 hours), due to emodin, resins—mainly phæoretin, etc.; then follows astringency from rheo-tannic acid; both actions being chiefly on the duodenum. The milk, urine, and sweat become colored, the first also acquiring bitterness and purgative properties. Purgation may result from its application to ulcers, abraded skin, or in poultices to abdomen.

**USES**.—Diarrhoea, hemorrhoids, cholera infantum, chronic dysentery, dyspepsia, thread worms. With calomel good in bilious fevers; with magnesium oxide for stomach and bowel disorders. By association with other cathartics both are rendered more efficient; sometimes used with opium.

*Allied Plants*:

1. *Rheum rha'pon'ticum*.—Asia Minor, Siberia, Russia. This is cultivated as pie-plant; the leaf-petioles being used, as they possess pleasant acidulous properties; this species is the source of the cultivated European rhizome, and that of Moravia (Austria), Hungary, England, and Banbury, which is usually less than half the size of official rhubarb, conical, harder, lighter colored, more bitter and astringent, less gritty; contains rhapontin,  $C_{22}H_{34}O_9$ .

2. *R. undula'tum*, *R. compac'tum*, *R. Emo'di*, *R. austr'al'e*, *R. hyb'ridum*.—All produce handsome, but smaller, less valuable, and lighter-colored rhizomes.

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3. *Rumex crispus*, *Yellow Dock*.—The dried root, official 1860–1900; Europe, N. America. Compact perennial springing from a yellow fusiform root, which penetrates far into the ground; stem rises annually 1–1.3 M. (3–4°) high; leaves lanceolate, smooth, margins strongly wavy-curved; flowers greenish, racemes. Root, 10–30 Cm. (4–12') long, 6–18 Mm. ( $\frac{1}{4}$ – $\frac{3}{4}$ ') thick, fusiform, deeply wrinkled, rusty-brown—internally whitish with reddish medullary rays; bark rather thick, fracture short; odor slight, peculiar; taste bitter, astringent; contains chrysophanic acid, emodin, tannin, calcium oxalate, starch, mucilage, (rumicin, lapathin). Astringent, alterative, tonic, laxative, antiscorbutic; similar to rhubarb and sarsaparilla; cutaneous eruptions, scorbutic manifestations, itch, scrofula, syphilis, hepatic congestion, dyspepsia, intermittents; leaves used as a laxative diet, and as spinach. Dose, gr. 15–60 (1–4 Gm.); fluid-extract (diluted alcohol), Mxv–60 (1–4 Cc.); decoction and ointment also employed.

FIG. 101.

*Rumex crispus*.

FIG. 102.

*Polygonum Bistorta*: rhizome, natural size.

4. *R. britan'nica*, *Water Dock*.—The root, official 1820–1860. Europe, naturalized in N. America. Plant 1.6–2 M. (5–6°) high, leaves lanceolate, acute, transversely veined, obscurely crenate, .3–.6 M. (1–2°) long; root more astringent but physically and medicinally similar to the official, with which it is often indiscriminately collected.

5. *R. obtusifolius*, *Broad-leaved Dock*.—The root, official 1820–1860. Europe, naturalized in N. America. Common obnoxious weed .6–1 M. (2–3°) high, leaves 15–30 Cm. (6–12') long, 7.5–10 Cm. (3–4') wide, sometimes red-veined, ovate, heart-shaped, downy, wavy margins, acuminate; roots similar to official, with which it is often indiscriminately collected, both alike medicinally.

6. *R. sanguineus*, *Red-veined Dock*.—Leaf-veins and stems reddish; *R. aquatilis*, fruit smooth, both astringent. *R. Acetosella*, *Field or Sheep Sorrel*, contains acid potassium oxalate and tartaric acid, sour taste lost upon drying; refrigerant, diuretic, good diet in scurvy.

4. *Polygonum Bistorta*, *Bistort*.—Europe, Asia, N. America, in meadows. Produces an S-shaped rhizome, bent upon itself—bistorted, 5 Cm. (2') long, 15 Mm. ( $\frac{3}{8}$ ') thick, flattened or channelled, upper side transversely striate, root-scars on under side, red-brown; contains tannin 20 p. c., starch, calcium oxalate; tonic, astringent. Dose, gr. 5–30 (.3–2 Gm.).

#### 24. CHENOPODIACEÆ. Goosefoot Family.

Ke-no-po-di-a'se-e. L. *Chenopodium* + aceæ, fr. Gr. γέν, goose, + πούς, foot—i. e., referring to the shape of leaves. Herbs, shrubs. Distinguished by being homely, succulent; leaves exstipulate, no bracts; flowers minute, greenish, with free calyx imbricated in the bud, persistent; 2–5-lobed; petals none; ovary 1-celled, forming 1-seeded utricle; universal, saline places; anthelmintic, antispasmodic, aromatic, carminative, stimulant (vol. oil).

Genus: 1. *Chenopodium*.

#### CHENOPODIUM. CHENOPODIUM.

*Oleum Chenopodii*. Oil of *Chenopodium*, official.

*Chenopodium anthelminticum*, Linné. } A volatile oil distilled from the fruit.

*Habitat*. W. Indies, C. and S. America; waste places, roadsides; naturalized in the United States, Europe, Africa; cultivated in Maryland for the oil.

*Syn*. American Wormseed, Wild Wormseed, Stinking Weed, Jerusalem or Jesuit Tea, Jerusalem Oak or Jak, Goosefoot, Wormseed Plant, Fructus *Chenopodii* Anthelmintici; Fr. Anserine Vermifuge (plante fleurie); Ger. Amerikanischer Wurmsamen.

*Che-no-po'di-um*. L. see etymology, above, of *Chenopodiaceæ*.

*An-thel-min'ti-cum*. L. fr. Gr. ἀντι, against, + ἐλμινθα, a worm—i. e., worm antagonist or destroyer.

**PLANT**.—Annual or perennial, .6–1.6 M. (2–5°) high; stem angular, furrowed, and branched; leaves toothed, yellowish-green, gland-dotted on under surface; flowers July–Sept., greenish-yellow, dense leafy spikes. Fruit, 2 Mm. ( $\frac{1}{12}$ ') thick, size of pin's head, depressed-globular, greenish-gray, integuments friable, containing a lenticular, obtusely edged, glossy, black seed; odor peculiar, terebinthinate; taste bitter, pungent. All parts of the plant have this disagreeable odor and same medicinal properties when dry and fresh; grows best in rubbish, along fences, in village streets, vacant lots, and should be collected in October.

**CONSTITUENTS**.—Volatile oil 3–3.5 p. c., from fresh herb .5–1 p. c.

*Oleum Chenopodii*. Oil of *Chenopodium*.—This volatile oil, obtained by distilling with water or superheated steam, is a thin, colorless or yellow liquid, peculiar, penetrating, camphoraceous odor, pun-

**CHENOPODIACEÆ.**

gent, slightly bitter taste, sp. gr. 0.980, soluble in 5 volumes 70 p. c. alcohol, levogyrate; contains a terpene—pinene,  $C_{10}H_{16}$ , and liquid oxygenated portion,  $C_{10}H_{16}O$ . Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{m}\text{ij}$ –10 (.13–.6 Cc.).

FIG. 103.



*Chenopodium anthelminticum* (*C. ambrosioides* var. *anthelminticum*).

**PREPARATIONS.**—(Unoff.) **FRUIT:** *Fluidextract*, dose,  $\mathfrak{m}\text{xv}$ –30 (1–2 Cc.). *Decoction* (water or milk), dose,  $\mathfrak{z}\text{j}$ –2 (30–60 Cc.). **FRESH-PLANT:** *Expressed Juice*, dose,  $\mathfrak{z}\text{ij}$ –4 (8–15 Cc.) *ter die*.

**PROPERTIES.**—Anthelmintic, vermifuge, round worms (*Ascaris lumbricoides*).

FIG. 104.



*Chenopodium ambrosioides*.

**USES.**—While mainly for worms, it has also been used in intermittents, hysteria, chorea, nervous affections, tænia. May give the powder incorporated with molasses or syrup, but the oil is most popular, and is well taken on sugar by children. Should be given twice daily for several days, on empty stomach if possible, and follow with a dose of castor oil. Fruit, official 1820–1900.

*Allied Plants:*

1. *Chenopodium ambrosioides*, *Herba Botryos Mexicanæ*, *Mexican Tea*.—The fruit, official 1890–1900; Europe, Asia. This resembles very closely the official plant, the latter being, however, more strongly aromatic, leaves more deeply toothed, the lower ones often nearly pinnatifid, spikes more elongated, mostly leafless; fruit of both alike.

2. *C. Bo'trys*, *Jerusalem Oak* (*Feather Geranium*).—Europe, Asia. Strongly aromatic; catarrh, asthma. *C. Bo'nus Henri'cus*, *Good King Henry*. Europe; taste saline, mucilaginous. *C. al'bum*, *Pig Weed*

(*Lamb's Quarters*); taste mucilaginous, saline. *C. Vulva'ria*, *Fetid Goosefoot*. Europe; plant has fish-brine odor, due to trimethylamine.

## 25. PHYTOLACCACEÆ. Pokeweed Family.

**Fi-to-la-ka'se-e.** L. *Phytolacca* + *aceæ*, fr. Gr. *φυτόν*, plant, + It. *lacca*, lake color, red—*i. e.*, alluding to crimson juice of the berries. Herbs, shrubs. Distinguished by possessing acrid principle; leaves entire; flowers perfect, 4–5's, petals none, ovary superior, several-celled, composed of as many carpels united in a ring, each with undivided style, forming a berry fruit, otherwise like *Chenopodiaceæ*; temperate climates, tropics; emetic, purgative, acrid principle destroyed by boiling water.

Genus: 1. *Phytolacca*.

### PHYTOLACCA. PHYTOLACCA.

**Phytolacca**  
**decandra**, Linné. } The dried root, collected in autumn.

*Habitat.* N. America, in waste places; naturalized in S. Europe, W. Indies.

*Syn.* *Phytolacce Radix*, U. S. P. 1890. Poke or Red Weed, Garget, Pocan, Bush, Cancer Jalap, American Nightshade, Skoke, Skoke, Coakum, Red Ink Plant or Berries, Pigeon Berry, Virginia Poke (*Phytolacce Bacca*, Poke Berry, U. S. P. 1880; *Phytolacce Fructus*, *Phytolacca Fruit*, U. S. P. 1890); Fr. Agouman, Morella à grappes, Raisin d'Amérique, Racine de Phytolaque; Ger. Kermesbeere, Amerikanische Kermesbeere, Kermesbeerenwurzel.

**Phy-to-lac'ca.** L. see etymology, above, of *Phytolaccaceæ*.

**De-can'dra** L. fr. Gr. *δέκα*, ten, + *ανδρός*, stamen—*i. e.*, flowers have 10 stamens.

*Poke*, corruption of *Pocan*, its former Virginia name.

**PLANT.**—Perennial herb; stem annual, purplish, hollow, 1.3–2.5 M. (4–8°) high, 2.5–5 Cm. (1–2') thick, smooth, branching; leaves 12.5 Cm. (5') long, 5–7.5 Cm. (2–3') wide, smooth, rich-green, entire, petioled, ovate, both ends acute; flowers June, greenish-white, racemes; fruit August, at first green, then purplish-black, depressed-globular, compound berry, 8 Mm. ( $\frac{1}{3}$ ') thick, composed of 10 carpels, each with 1 lenticular black seed, juice purplish-red; inodorous; taste sweet, acrid, when clusters dried resembles grapes or raisins. **ROOT**, cylindrical, somewhat tapering, sparingly branched, 3–7 Cm. (1–3') thick, mostly in transverse or longitudinal slices, yellowish-brown, finely longitudinally or spirally wrinkled and thickly annulate with lighter colored low ridges, fracture fibrous, characterized by alternating layers of fibrovascular tissue and parenchyma, layers of latter much retracted; odor slight; taste sweetish, acrid. *Solvents*: alcohol; diluted alcohol; boiling water. Dose, alterative, gr. 1–5 (.06–.3 Gm.); emetic, gr. 10–30 (.6–2 Gm.).

**ADULTERATIONS.**—Occasionally, to a limited extent—inula, rumex, podophyllum, etc.

**CONSTITUENTS.**—Glucoside (active, poisonous, amorphous, bitter, possibly identical with saponin), sugar 10 p. c., starch 11.7 p. c., formic acid, potassium formate 2 p. c., calcium oxalate 6.2 p. c., ash



**PHYTOLACCACEÆ.**

8–13 p. c. (potassium oxide, calcium oxalate and nitrate). Some believe the activity to depend upon phytolaccine, phytolaccin, and phytolaccic acid, all three being present—the first an alkaloid in white

FIG. 105.



*Phytolacca decandra*: 2, single fruit, showing carpels.

crystals, soluble in alcohol, slightly in water, nearly insoluble in ether, chloroform; the second a glucoside resembling tannin; the third amorphous, soluble in water, alcohol, reducing silver salts.

The "Eclectic" resinoid, *phytolaccin*, is soluble in alcohol. Dose, gr. 1–3 (.06–.2 Gm.).

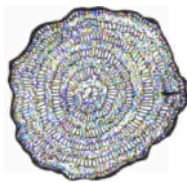
**PREPARATIONS.**—1. *Fluidextractum Phytolacæ*. Fluidextract of Phytolacca. (Syn., Extractum Phytolacæ Radicis Fluidum, U. S. P. 1890, Fluidextract of Poke Root; Fr. Extrait liquide du Racine de Phytolaque; Ger. Flüssiges Kermesbeerenwurzel-extrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, ℥v–30 (.3–2 Cc.).

**Unoff. Preps.:** *Decoction*, 5 p. c., dose, ℥iv–8 (15–30 Cc.). *Tincture*, 10 p. c. (diluted alcohol), dose, ℥x–60 (.6–4 Cc.). *Ointment* (fluidextract of root or leaves 1 + lard 8). *Decoction and Fresh Juice of Leaves* are also used.

**PROPERTIES.**—Alterative, laxative, emetic, anodyne, resolvent, paralyzes spine and muscles of respiration, death preceded by tetanic con-

FIG. 106



Phytolacca root: transverse section, natural size.



vulsions. Overdose (3ij–4; 8–15 Gm.) produces in 2 hours vomiting, purging, thirst, prostration, cold skin, feeble pulse, vertigo, dim vision, coma, convulsions, death; similar to veratrum, except the vomiting is usually delayed.

USES.—Rheumatism, skin diseases, syphilis. Internally and externally for ulcers, scabies, tinea capitis, eczema, sycosis, mange in dogs, tonsillitis, diphtheria, pharyngitis, glandular conjunctivitis, scrofula, hemorrhoids. May prevent mastitis (gathered breasts).

Poisoning: Same as for aconite and veratrum.

Incompatibles: Cardiac stimulants, opium.

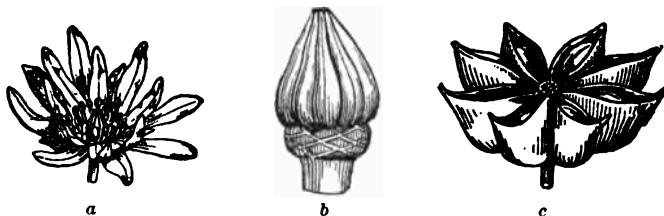
Synergists: Cardiac sedatives, motor depressants, emetics.

Allied Plants:

1. *Phytolacca octan'dra*, C. and S. America, and *P. acino'sa*, N. India, are used similarly.—These and the official furnish young shoots which in spring may be eaten for asparagus, spinach, etc., imparting no odor to urine, but when old none should be taken except in medicinal doses.

2. *Illicium ve'rum*, *Star Anise*.—Magnoliaceæ. The fruit, official 1880–1900; N. Annam, S. W. China (mountains). Small tree, 3–6 M. (10–20°) high, branched; leaves evergreen, lanceolate, pointed, entire, pellucid punctate, 5–15 Cm. (2–6') long; flowers greenish-yellow. Fruit (capsule—integuments 78 p. c., seeds 22 p. c.), star-shaped,

FIG. 107.



*Illicium verum*: a, flower; b, fruit carpels of the flower magnified; c, fruit.

being composed of 8 stellately arranged boat-shaped carpels, 8 Mm. ( $\frac{1}{3}$ ') long, woody, wrinkled, brown, dehiscent on upper suture; internally each carpel glossy, reddish-brown, containing 1 flattish, oval, glossy-brown seed; odor anise-like (*anisatum*); taste sweet, aromatic—seeds oily; contains (integuments)—volatile oil 5.3 p. c. (congeals at 1° C.; 34° F., and consists chiefly of anethol), resin 10.7 p. c., fixed oil 2.8 p. c., saponin, protocathechuic acid, shikimic acid, mucilage, ash 2 p. c.; (seeds)—volatile oil 1.8 p. c., resin 2.6 p. c., fixed oil 20 p. c.; solvents: alcohol, hot water partially. Adulteration—Poisonous fruit of the allied species, *Illicium religiosum* (*anisatum*). Carminative, anodyne, stimulant, diuretic; flatulent colic, indigestion, infantile catarrh, bronchitis, rheumatism, earache, flavoring. Dose, gr. 5–30 (.3–2 Gm.); infusion, 5 p. c., 3j–2 (30–60 Cc.); volatile oil, Mj–2 (.06–.13 Cc.).

3. *I. religio'sum* (*anisa'tum*).—Cultivated around Buddhist temples in China and Japan, being called *Shikimi*. Fruit very similar to the

**PHYTOLACCACEÆ.**

preceding, having 8 carpels, but is more woody and shrivelled, with thin, upward-curved beak; odor faint, clove-like; taste unpleasant. This contains 0.44 p. c. of non-solidifying volatile oil, sp. gr. 0.990, shikimic acid, sikimipicrin (crystalline, bitter), and sikimin (poisonous). The oil contains a terpene, safrol,  $C_{10}H_{10}O_2$ , eugenol,  $C_{10}H_{12}O_2$ , and liquid anethol. The fruit is used natively for killing rats, fish, etc., the latter serving as food in spite of the poison. Upon persons it causes vomiting, epileptiform convulsions, and dilated pupils; *I. floridanum* and *I. parviflorum*. Fla., Ga., La.; the former has fruit with 13 carpels, the latter with only 8; barks are sometimes substituted for cascarilla.

FIG. 108.

*Illicium religiosum (anisatum).*

FIG. 109.

*Drimys Winteri.*

4. *Dri'mys Win'teri* (*Win'tera aroma'tica*).—The bark, official 1820–1860; S. America; small tree; leaves coriaceous; flowers white; fruit black berries, 4–8; bark in quills or curves, 2.5–8 Mm. ( $\frac{1}{10}$ – $\frac{1}{3}$ ') thick, grayish-brown, striate, fracture granular, with white stone-cells and yellow resin-cells, odor of canella and cinnamon, for which drugs it has been substituted; sometimes called Winter's cinnamon; contains volatile oil (which has winterene,  $C_{15}H_{24}$ ), tannin 9 p. c., pungent resin 10 p. c. Used for colic, flatulence, scurvy; in infusion or tincture. Dose, gr. 5–30 (.3–2 Gm.).

5. *Magno'lia virginia'na* (*glau'ca*), *M. acumina'ta*, and *M. tripet'ala*.—

The bark, official 1820–1890; United States; trees 6–28 M. (20–90°) high; flowers white, fragrant; fruit cones; bark in thin quills or curved pieces, orange-brown, glossy, warty, fissured, astringent, bitter; contains volatile oil, resin, magnolin, tannin. Used for malaria, rheumatism, gout, intermittents, catarrhs; in decoction, infusion, tincture. Dose, ʒss–1 (2–4 Gm.).

6. *Liriodendron Tulipifera*, *Tulip-tree*.—The bark, official 1820–1880; United States, China; tree 18–45 M. (60–150°) high; flowers

FIG. 110.

*Magnolia acuminata.*

yellowish; fruit cone, 7.5 Cm. (3') long. Bark in quills or curved pieces 2 Mm. ( $\frac{1}{12}$ ') thick, purplish-brown, thin ridges, inside whitish, smooth, astringent; contains volatile oil, resins, liriodendrin, tulipiferine, tannin; injured by boiling. Used for chronic rheumatism, dyspepsia, intermittent fever; in infusion or fluidextract. Dose, ʒss–1 (2–4 Gm.).

## 26. MYRISTICACEÆ. Nutmeg Family.

Mi-ris-ti-ka'se-e. L. *Myristica* + aceæ, fr. Gr. *μυρίτζεν*, to anoint—*i. e.*, an ointment used for its sweet odor. Trees. Distinguished by aromatic properties; leaves dotted, entire, stalked, leathery; flowers regular, dioecious, calyx 3–4-cleft, leathery, inferior; filaments 3–12, united, ovary 1-celled, ovule 1; fruit succulent, seed oily; tropics; aromatic, seeds the strongest; bark and pericarp acrid.

Genus: 1. **Myristica**.

## MYRISTICA. MYRISTICA.

**Myristica**  
**fragrans**, *Houttuyn*. } The kernel of the ripe seed.

*Habitat*. Molucca Islands; cultivated in tropics, India, Philippine Islands, S. America, Ceylon, Sumatra, Java, etc.

*Syn.* Nutmeg; Fr. Muscade, Noix Muscade, Nux Muschata, Nucis Nucistæ; Ger. Semen Myristicæ, Muskatnuss, Myristicasamen.

**My-ris'ti-ca**. L. see etymology, above, of Myristicaceæ.

**Fra'grans**. L. *fragran(t)s*, sweet-scented—*i. e.*, from its fragrant odor.

*Nutmeg*. OE. *nut* + *muge*, musk, corrupted into *meg*—*i. e.*, from its odor.

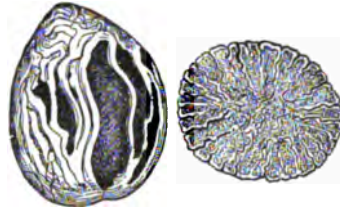
**MYRISTICACEÆ.**

**PLANT.**—Evergreen tree 7.5–15 M. (25–50°) high, much branched, bark brownish-gray, smooth, young branches green; leaves leathery, smooth, entire, 10–15 Cm. (4–6') long, acute at both ends, prominently veined, dark green; flowers dioecious, small, yellow; fruit pendulous, smooth, yellow, 7.5 Cm. (3') long, 5 Cm. (2') wide, resembling a peach, but grooved by a longitudinal furrow, pericarp, 12 Mm. ( $\frac{1}{2}$ ') thick, tough, fleshy, with astringent juice, yellowish-white, dehiscing from above along the furrow into 2 equal valves, which when ripe become dry, coriaceous, and from between these readily falls out an erect, single seed, 3 Cm. ( $1\frac{1}{2}$ ') long, 18 Mm. ( $\frac{3}{4}$ ') thick, ovoid, blunt,

FIG. 111.

*Myristica fragrans*: twig with the fruit.

FIG. 112.



Nutmeg, with mace, and transverse section.

FIG. 113.



Wild nutmeg, with mace.

closely enveloped and almost completely covered by an irregularly cut, fleshy arillus (mace); when deprived of this, the seed-testa is dark brown, hard, thick, smooth, shining, woody, reticulately furrowed from the tightly oppressed arillus; inner seed-coat thin, membranous, pale brown. **KERNEL** (myristica, nutmeg), ovoid or elliptical, 25 Mm. (1') long, light brown, reticulately furrowed, circular scar and embryo at broad end, internally mottled from the infolding of the light brown perisperm and tegmen with the yellowish-brown endosperm, easily cut, giving waxy lustre surface; odor strongly aromatic; taste agreeably aromatic, warm, slightly bitter. Some treat the hard testa and kernel as the seed, like peach seed, but the U. S. P. recognizes solely (the

kernel or nucleus) that central part left, after the fleshy portion, arillus, and hard testa have been removed. *Solvents*: alcohol; ether. Dose, gr. 5–20 (.3–1.3 Gm.).

*Commercial*.—Nutmeg trees prefer light soil, shade, and moist climate. They produce fruit when 8–9 years old, are matured at 25, and yield annually for 60–70 years; the fruit is collected Sept.–Dec., also April–June (when it has split on one or both sides), by means of a hook on long poles or by hand in a basket; the pericarp and arillus are removed and seed dried by sun or fire at 60° C. (140° F.), being spread on frames for 2 months and turned over every few days. When kernels rattle in their shells these latter are cracked off with mallets, kernels are then assorted, and the best rubbed over with powdered lime; they are packed in whitewashed casks for market. The Chinese are supplied with uncracked seed; while inferior grades are used for expressing the oil. We have several varieties: 1. *Unlimed, Penang, Singapore*, as above described, sometimes oily to touch and mixed with cloves. 2. *Limed, Dutch*. Prepared in the Banda Islands by dipping dried seed into a mixture of salt water and lime as a protection against insect attacks, and possibly to kill the embryo (thus limiting their culture to their own provinces), then exposing to sun several days, and packing for market. 3. *Artificial*. Prepared by compression of a mixture of powdered earthy matter; soft and crumbly by three minutes' contact with boiling water; aroma weaker than genuine; contains volatile oil 2 p. c., fat 15 p. c., ash 11–18 p. c. Ground nutmeg is adulterated largely with exhausted refuse. Ancients were unacquainted with drug, Avicenna being the first to notice it.

*CONSTITUENTS*.—Volatile oil 2–8 p. c., Fixed oil 25–30 p. c., starch, proteids, mucilage, ash 2 p. c.

*Oleum Myristicæ*. Oil of *Myristica*, *official*.—(Syn., Oil of Nutmeg, *Oleum Nucistæ* *Æthereum*; Fr. *Essence de Muscade*; Ger. *Oleum Macidis*, *Ätherisches Muskatnussöl*.) This volatile oil, obtained by distilling nutmeg with water or steam, is a thin, colorless or pale yellowish liquid, characteristic odor of nutmeg, warm, spicy taste, darker and thicker by age, sp. gr. 0.885, soluble in equal volume alcohol, in 3 volumes 90 p. c. alcohol, dextrogyrate; contains chiefly pinene, probably some dipentene, also myristicol,  $C_{10}H_{16}O$ , and myristicin,  $C_{12}H_{14}O_3$ . The nutmeg camphor (formerly thought to be myristin), which sometimes settles upon standing, is myristic acid. *Test*: 1. Oil 2–3 Cc. evaporated on water-bath gives no residue, which crystallizes on cooling. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{m}\text{j}$ –3 (.13–.2 Cc.).

*Fixed Oil*. (*Oleum Myristicæ Expressum*, *Oleum Nucistæ*).—Obtained by bruising nutmegs, exposing them in a bag to steam, and expression between heated plates; the oil runs out a liquid, but congeals upon cooling; often called *nutmeg butter*, and improperly *oil of mace*; it is an orange-brown solid, sp. gr. 0.995, melting at 45° C. (113° F.), soluble in 2 parts hot ether, 4 hot alcohol; consists mainly of myristin, with some myristic acid, palmitin, olein, resin, volatile oil 6 p. c. Dose, gr. 2–5 (.13–.3 Gm.).

**RANUNCULACEÆ.**

PREPARATIONS.—I. SEED: 1. *Acetum Opii*, 3 p. c. 2. *Pulvis Aromaticus*, 15 p. c. 3. *Tinctura Lavandulæ Composita*, 1 p. c. 4. *Tinctura Rhei Aromatica*, 2 p. c. 4. *Trochisci Sodii Bicarbonatis*,  $\frac{1}{10}$  gr. (.01 Gm.). II. OIL: 1. *Spiritus Ammaniae Aromaticus*,  $\frac{1}{10}$  p. c.

PROPERTIES.—Stimulant, stomachic, narcotic, flavoring, condiment, increases gastric juice, digestion, appetite; large doses, like camphor, act on the cerebrum, causing stupor, delirium.

USES.—Flatulence, carminative, diarrhœa, dysentery, vomiting, colic, dyspepsia.

*Allied Products:*

1. *Macis*, *Mace*.—The arillode of the seed of *Myristica fra'grans*, official 1850–1900. When the fruit is gathered, the fleshy pericarp first is removed, and then the thin coating (arillode) enveloping the seed is peeled off with a knife and dried by sun or fire; or it may be allowed to remain on the seed until thoroughly dry, when it freely cracks and peels off. It is a brilliant-scarlet (fresh), or brownish-orange (dry), brittle, in narrow bands, 2.5 Cm. (1') long, branched, lobed above, fatty when scratched or pressed, fracture short, showing many oil-cells; odor fragrant; taste warm, aromatic; contains oil (oleum macidis) 8 p. c., resin, fat, sugar, dextrin, mucilage, proteid. (no starch), ash 1–2 p. c.; solvent: alcohol. *Tinctura Macidis*, 20 p. c. (alcohol). Often adulterated in entire and powdered forms with mace of *M. malabar'ica* and *M. fatua*, both being readily detected by darker reddish color, more fatty, resinous, lustrous surface, weaker taste and odor, yielding ten times more ether-extract. Stimulant, tonic, flavoring. Dose, gr. 5–20 (.3–1.3 Gm.).

2. *False Nutmegs*, *M. fatua*, *Long*, *Wild* or *Male Nutmegs*.—These are 4–5 Cm. ( $1\frac{3}{8}$ –2') long, the mace inodorous, less deeply lobed, kernel paler, less aromatic than the official.

3. *Tor'reya califor'nica*, *California Nutmegs*, Pinacæ.—Testa smooth, brittle, kernel oblong, marbled, terebinthinate odor and taste; tree attains an altitude of 21 M. (70°), wood odorous, light-colored, close-grained.

**27. RANUNCULACEÆ. Crowfoot Family.**

Ra-nung-ku-la'se-e. L. *Ranuncul-us* + acæ, dim. of *rana*, a frog; hence little frog, as many species grow in moist places near that reptile. Herbs or shrubs with colorless, acrid, poisonous juice. Distinguished by flowers being regular or irregular, most complete; organs all distinct; no adhesion nor cohesion; often yellow; sepals 3–15, mostly 5 (often petaloid); petals 3–15; only 1 circle; stamens many, hypogynous; pistils distinct; seed albuminous, superior; temperate climates; narcotic, bitter, tonic, poisonous.

Genera: 1. *Hydrastis*. 2. *Cimicifuga*. 3. *Delphinium*. 4. *Aconitum*.

## HYDRASTIS. HYDRASTIS.

**Hydrastis** } The dried rhizome and roots, containing 2.5 p. c.  
**canadensis**, Linné. } of hydrastine.

*Habitat.* N. America, Canada, east of Mississippi, in rich woodlands, mountains.

*Syn.* Golden Seal, Eye Balm or Root, Indian Plant or Dye, Yellow Puccoon or Paint, Jaundice-Orange, Turmeric, Yellow-, or Eye Root, Yellow Eye, Puccoon of Indian Paint, Ground Raspberry, Ohio Curcuma; Br. Rhizoma Hydrastis, Hydrastis Rhizome; Fr. Racine Orange, Sceau d'Or; Ger. Canadische Gelbwurzel.

**Hy-dras'tis.** L. fr. Gr. *idwup*, water, + *ôpâw* to act—i. e., alluding to the active properties of the juice, or to the plants growing in marshy places.

**Can-a-den'sis.** L. of Canada—i. e., its northern habitat limit.

*Golden Seal*—i. e., its yellow scarred rhizome, once used as a paint and dye.

**PLANT.**—Perennial herb 15–30 Cm. (6–12') high, simple, hairy, 2-leaved near apex, one sessile at top, the other an inch or so below with thick petiole; leaves pubescent, round, cordate, palmately 5–7-lobed, pointed, serrate, 10–22.5 Cm. (4–9') wide; flowers May–June, only one, greenish-yellow, arising from upper leaf on a peduncle; fruit compound red berry, 12 Mm. ( $\frac{1}{2}$ ') thick, composed of 12 or more 1–2 seeded berries like raspberry. **RHIZOME**, of oblique growth, subcylindrical, straight or tortuous, 2–5 Cm. ( $\frac{4}{5}$ –2') long, 3–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') thick, with short stem remnants or scars, slightly annulate, brownish-gray to yellowish-brown, fracture short, waxy, deep yellow, bark 0.5 Mm. ( $\frac{1}{50}$ ') thick, wood wedges (10) bright yellow, pith large, light yellow, roots thin, brittle, with thick, yellow bark, and somewhat quadrangular wood; odor distinct; taste bitter; powder should contain no crystals, and starch grains are single; sulphuric acid to sections under microscope shows separation of the alkaloids in prismatic tabular and acicular crystals. *Solvents*: diluted alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—Rhizomes of *Aristolochia Serpentina* and *A. reticulata*, *Cypripedium hirsutum* and *C. parviflorum*, *Asarum canadense*, *Xanthorrhiza apiifolia*, and also roots of *Styloph'orum diphy'llum*.

**Commercial.**—The Cherokee Indians imparted the value of hydrastis to the American settlers, it being used by them very early as a domestic remedy and dye; it did not attract medical attention until 1798; soon became a great "Eclectic" drug and afterward one of our important agents.

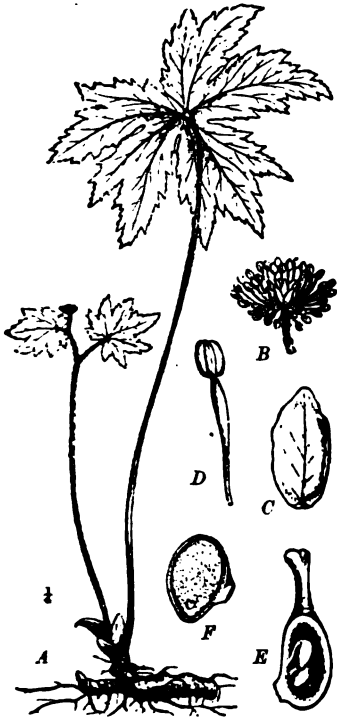
**CONSTITUENTS.**—Hydrastine 1.5–3.14 p. c., Berberine 3–4 p. c., Canadine (resin, fluorescent compound, starch, sugar, gum, fat, coloring matter).

**Hydrastina, Hydrastine**,  $C_{21}H_{21}NO_6$ , *official*.—(Syn., Fr. Hydrastine; Ger. Hydrastin.) This characteristic colorless alkaloid is obtained by adding hydrochloric or sulphuric acid in excess to an alcoholic tincture of hydrastis, whereby the corresponding berberine salt deposits in crystals; to the filtered mother-liquor add ammonia water until acidity is nearly neutralized, strain to remove ammonium salt, concentrate to a syrupy consistence and pour this into 10 volumes of cold water, to re-

## RANUNCULACEÆ.

move fat and resin; to the filtrate, containing crude hydrastine salt, add ammonia water in excess to precipitate impure alkaloid, which may be purified by dissolving in diluted sulphuric acid, again precipitating with ammonia, and repeated crystallization from hot alcohol; occurs in white glistening bitter prisms, permanent, soluble in benzene, 135 parts alcohol, 124 ether, 2 chloroform, nearly insoluble in water; forms several salts, as hydrochloride, phosphate, sulphate, etc. *Tests*: 1. With sulphuric acid get yellow color (changing to purple upon heating), + potassium dichromate get red color changing to brown (dif.

FIG. 114.



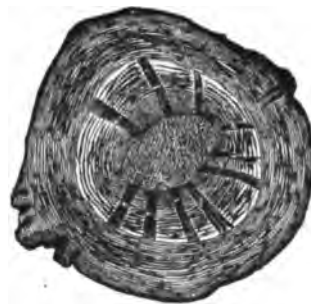
*Hydrastis canadensis*: B, flower; C, petal; D, stamen; E, fruit carpel, longitudinal section; F, seed.

FIG. 115.



*Hydrastis canadensis*: rhizome.

FIG. 116.



*Hydrastis* rhizome: transverse section, magnified.

from strychnine—violet). 2. Solution in diluted sulphuric acid + solution of potassium permanganate (1 in 10) gives blue fluorescence (dis. from hydrastinine). Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.016–.03 Gm.).

**Hydrastininæ Hydrochloridum, Hydrastinine Hydrochloride**, ( $C_{11}H_{11}NO_2 \cdot HCl$ , *official*.—(Syn., Hydrastininæ Hydrochloras, U. S. P. 1890; Ger. Salzsäures Hydrastinin.) This hydrochloride of the artificial alkaloid is obtained by treating hydrastine with an oxidizing agent (nitric acid, potassium dichromate or permanganate, etc.) in acid solution—dissolve hydrastine 10 Gm. in nitric acid 75 Cc., heat to



60° C. (140° F.), upon cooling opianic acid crystallizes out; adding to filtrate potassium hydroxide solution precipitates the hydrastinine, which may be purified by recrystallizing from benzene or acetic ether, dissolving crystals in hydrochloric acid, crystallizing from alcohol; occurs in yellowish-white needles or crystalline powder, odorless, bitter, soluble in water, alcohol, 286 parts chloroform, 1300 ether, melts at 212° C. (414° F.), no residue. *Tests*: 1. Aqueous solutions show blue fluorescence, not precipitated by ammonia, but by potassium dichromate T. S. 2. Crystal + sulphuric or nitric acid gives deep yellow color; sulphuric acid + trace nitric acid gives reddish-brown color; sulphuric acid + crystal ammonium vanadate gives light-brown color changing to dark brown. 3. Aqueous solution (1 in 20) + bromine T. S. gives yellow precipitate, dissolving clear in ammonia water (dif. from hydrastine—brick-red). Used chiefly for uterine hemorrhage (hypodermically), also as oxytocic; slows heart, but increases force of contraction, motor-depressant, paralyzant. Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.02–.03 Gm.), in 10 p. c. solution.

**Berberine**,  $C_{20}H_{17}NO_4$ .—This colored alkaloid is obtained by the preceding process for separating hydrastine; occurs in bitter yellow needles, or crystalline powder, soluble in hot water or alcohol; the hot alcoholic solution with iodine gives dark-green lustrous scales; it forms several yellow salts, carbonate, hydrochloride, phosphate, sulphate, etc., which dissolve in water with difficulty. This alkaloid is found also in berberis, calumba, coptis, menispermum, xanthorrhiza, etc. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

**Canadine**,  $C_{20}H_{21}NO_4$ .—This forms white needles; in alcoholic solution, with iodine get yellow crystals; it is called sometimes tetrahydroberberine, and differs from hydrastine in being more soluble in acetic ether and alcohol; only the hydrochloride and sulphate are easily soluble in alcohol or hot water. The name xanthopuccine once was assigned to this alkaloid, but as such it was very likely impure berberine.

**Assay**: Shake 15 Gm. finely powdered drug with ether 150 Cc., add ammonia water 5, shake, add distilled water 15, shake until drug collects in masses; shake out 100 Cc. with 15 normal sulphuric acid V. S., draw off acid solution, shake ether-solution with 5 normal sulphuric acid V. S., render acid solutions alkaline with ammonia water, shake out with ether 25, 20, 15, evaporate off the ether, and to dryness; weight of residue multiplied by 10 = p. c. of hydrastine present.

**PREPARATIONS**.—1. *Fluidextractum Hydrastis*. Fluidextract of Hydrastis. (Syn., Extractum Hydrastis Fluidum, U. S. P. 1890; Br. Extractum Hydrastis Liquidum; Fr. Extrait liquide de Hydrastis; Ger. Hydrastis-Fluidextrakt, Flüssiges Hydrastisextrakt.)

**Manufacture**: Macerate, percolate 100 Gm. with glycerin 10 Cc., alcohol 60, water 30, finishing with alcohol 65 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 2 Gm. of hydrastine. **Assay**: To 10 Cc. add distilled water 85 containing 2 Gm. potassium iodide, + water q. s. 100 Cc., shake, filter 50 into separator,

**RANUNCULACEÆ.**

render alkaline with ammonia water, shake out with ether 30, 20, evaporate ether solutions to dryness; multiply weight by 20 = weight in Gm. of hydrastine in 100 Cc. of fluidextract. Dose, ℥v-30 (.3-2 Cc.).

2. *Tinctura Hydrastis*. Tincture of Hydrastis. (Syn., Fr. Teinture de Hydrastis; Ger. Hydrastisiinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol 65 p. c., q. s. 100 Cc.: when assayed each 100 Cc. should contain 0.4 Gm. of hydrastine. *Assay*: Evaporate 100 Cc. to 10 Cc., and proceed approximately as in assay of the fluidextract, except the weight of residual alkaloids must be multiplied by 2 instead of 20. Dose, ʒss-1 (2-4 Cc.).

3. *Glyceritum Hydrastis*. Glycerite of Hydrastis. (Syn., Fr. Glycéri d'Hydrastis du Canada; Ger. Gilbwurzelglycerit.)

*Manufacture*: 100 p. c. Macerate, percolate 100 Gm. with alcohol until exhausted, remove nearly all the alcohol by distillation or evaporation, pour thick liquid into ice-cold water 50 Cc., set aside 24 hours, filter out resin, pass through filter water q. s. 50 Cc., add glycerin 50 Cc. This is used in injections, sprays, etc., instead of colorless proprietary preparations on the market. Dose, ℥v-30 (.3-2 Cc.).

*Unoff. Preps.*: *Decoction*, 5 p. c., dose, ʒj-2 (30-60 Cc.). *Hydrastin* of "Eclectics" is a resinoid, prepared by exhausting the drug with alcohol, evaporating, and precipitating with acidulated (HCl) water; it is chiefly berberine muriate, which often occasions for it the substitution of the pure hydrochloride of that alkaloid, dose, gr. 2-6 (.13-.4 Gm.).

**PROPERTIES.**—Upon digestion, circulation, respiration, and nervous system analogous to, but much milder than, strychnine. Bitter tonic, increases appetite, digestion, gastric secretions (berberine), and the flow of bile; antiperiodic, protoplasmic poison, interfering with the white blood-corpuscle movement, ~~alterative~~ to the mucous membranes, deobstruent to the glandular system, antiseptic, cholagogue, diuretic. Hydrastine acts on the nervous system like quinine, but it is non-toxic, as large doses only produce warmth in the stomach and ringing in the ears.

**USES.**—Chronic dyspepsia and cystitis, catarrhs of the stomach, duodenum, gall-ducts, bladder, uterus and vagina, constipation, bronchitis, malaria, intermittent fever, jaundice. Locally in gonorrhœa, leucorrhœa, otorrhœa, gleet, chronic nasal catarrh and pharyngitis, syphilitic sores in the mouth, nares, and throat, unhealthy intractable ulcers and sores, cancers, fistulas, hemorrhoids, fissured nipples, conjunctivitis, tonsillitis, hemorrhage. Hydrastine for chronic malaria is much weaker, but next in value to quinine; hydrastinine (hypodermically) for menorrhagia and metrorrhagia. The yellowish liquids are objectionable owing to their staining properties, for which, however, the Indians valued them in dyeing fabrics yellow; with indigo they impart a fine green to wool, silk, and cotton.

*Poisoning*: Same as for nux vomica and strychnine.

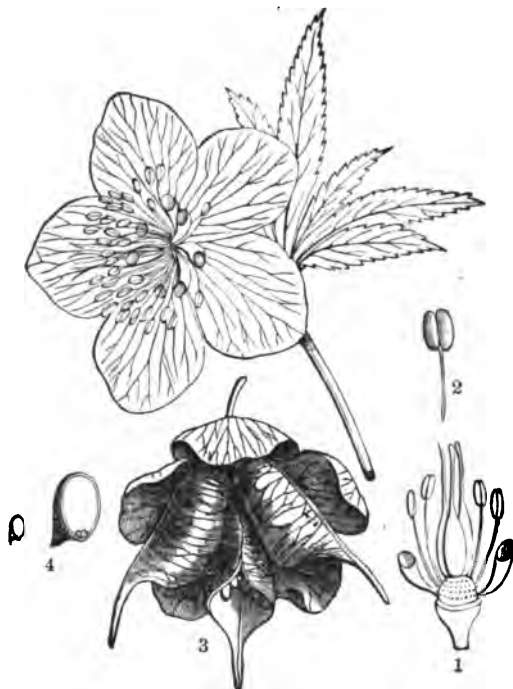
*Incompatibles*: Alkalies, mineral acids, tannic and other vegetable acids, hydrated chloral, potassium bromide, motor depressants.

*Synergists*: Quinine and the vegetable tonics upon the stomach, ergot upon the uterus, and strychnine upon the spinal cord.

*Allied Plants*:

1. *Helleb'orus ni'ger*, *Black Hellebore*.—The dried rhizome and roots, official 1820–1880; C. and S. Europe, mountains. Acaulescent perennial, leaves evergreen, 7–9-lobed, flowers rose-like. Rhizome knotty. 5 Cm. (2') long, 12 Mm. ( $\frac{1}{2}$ ') thick, blackish, bark thick, wood-wedges

FIG. 117.



*Helleborus viridis*: 1, receptacle, tricarpelled ovary, and stamens; 2, a stamen; 3, the three resulting ripened fruits; 4, a seed.

8, medullary rays broad, taste sweet, bitter, usually from Germany; contains helleborin, helleborein, helleboretin, resin, volatile oil, fixed oil, gum, etc. Heart stimulant, drastic hydragogue cathartic, alterative; used for melancholy, mania, dropsy, amenorrhœa, epilepsy, skin troubles; in decoction, infusion, tincture, extract. Dose, gr. 5–20 (.3–1.3 Gm.).

2. *H. fœ'tidus*, *Bear's Foot*.—The leaves, official 1820–1840; Europe. Perennial herb—the most energetic of the genus. Used for asthma, hysteria, hypochondriasis, tænia; in powder, decoction, syrup. Dose, gr. 5–20 (.3–1.3 Gm.). *H. vir'idis*, *Green Hellebore*. The rhizome (root), United States, Europe; rhizome about the same as *H. niger*, but has only 4 wood-wedges, and is smaller.

## RANUNCULACEÆ.

3. *Adonis vernalis*, *False Hellebore*.—N. Europe, Asia. Plant 25 Cm. (10') high, leaves light green, pinnatifid, flowers yellow; contains chiefly *adonidin* (adonin), an intensely bitter, yellow, hygroscopic glucoside, soluble in water, alcohol. Cardiac stimulant, mild diuretic; resembles *digitalis*, but is more prompt, non-cumulative; mitral and aortic regurgitation, precordial pain, dyspnoea. Dose of adonidin, gr.  $\frac{1}{16}$ — $\frac{1}{8}$  (.004–.02 Gm.).

4. *Cop'tis trifolia*, *Gold thread*.—The rhizome (root), official 1820–1880, N. America. Plant with scape 7.5–12.5 Cm. (3–5') high, leaves radical, 3-foliate, flowers May, whitish. Rhizome golden-yellow, filiform, fruit 7 follicles with black seeds, inodorous, bitter; contains berberine, coptine (white, possibly identical with hydrastine), resin. Used for ulcerated mouth; in infusion, decoction, tincture (10 p. c.). Dose, gr. 15–60 (1–4 Gm.).

5. *Xanthorrhiza apiifolia*, *Shrub Yellow-Root*.—The rhizome and roots, official 1820–1880; S. and C. United States. Shrub .6–1 M. (2–3°) high, stem clustered, 6 Mm. ( $\frac{1}{4}$ ') thick, wood yellow, leaves compound, flowers April, purple, racemes, rhizome .6–1 M. (2–3°) long, 12 Mm. ( $\frac{1}{2}$ ') thick, yellowish internally and externally, bitter; contains berberine, resin, starch, gum, etc. Used as a tonic like *calumba* or *quassia*; in infusion, decoction, tincture. Dose, 3ss–1 (2–4 Gm.).

## CIMICIFUGA. CIMICIFUGA.

**Cimicifuga racemosa**, (Linné) Nuttall. } The dried rhizome and roots.

*Habitat.* United States, Canada; in rich woodlands.

*Syn.* Black Snakeroot, Black Cohosh, Bugbane, Bugwort, Rattle Root, Rattleweed, Rattlesnake's Root, Rich Weed, Squaw Root; Br. *Cimicifugæ Rhizoma*, Actææ *Racemose Radix*; Fr. Racine d'Actée à Grappes; Ger. Schwarze Schlangenzwurz.

*Cim-i-ol'u-ga.* L. *cimex*, bug, + *fugare*, to drive away—i. e., from the fact of *Cimicifuga fetida* being used for that purpose in Siberia and Kamtschatka.

*Ra-ce-mo'sa.* L. *racemosus*—i. e., full of clusters, racemes—i. e., the flowers.

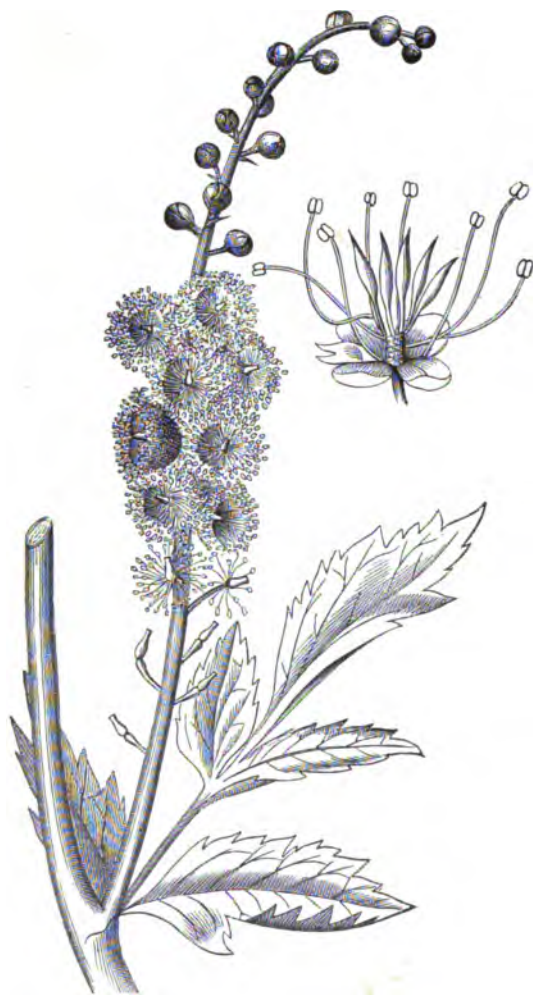
**PLANT.**—Perennial; stem slender, unbranched, 1.5–2.5 M. (5–8°) high; leaves irregularly ternately decompound, the rather small leaflets incised, 2.5–7.5 Cm. (1–3') long; flowers June–July, regular, numerous, small, white, in wand-like racemes, 20–50 Cm. (8–20') long, emit disagreeable odor. **RHIZOME**, horizontal in growth, 2–15 Cm. ( $\frac{1}{2}$ –6') long, 1–2.5 Cm. ( $\frac{2}{3}$ –1') thick, with many thick, ascending branches 2.5 Cm. (1') long, each terminated by a deep cup-shaped scar; roots numerous, brittle, obtusely quadrangular, 2 Mm. ( $\frac{1}{12}$ ') thick; brownish-black, fracture horny, smooth, exhibiting large pith, surrounded by many whitish, radially sublinear xylem plates (wood-rays); bark thin, firm; root-bark thick, wood 4-rayed; odor slight, heavy; taste bitter, acrid. Rhizome should be collected in autumn, and used only when fresh. *Solvents*: boiling water; alcohol. Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—Seldom met with; sometimes caulophyllum, podophyllum, each to the extent of 1 p. c., and smaller amount of comfrey, this latter imitating well the blackish color. *Actæa spicata*,

a very common European plant, has closely resembling rhizome, but juicy berries, whereas our official plant bears dry follicles. *Actæa racemosa* is but a synonym of *Cimicifuga racemosa*.

CONSTITUENTS.—Cimicifugin, resins 3.5 p. c., amorphous resinous body (probably the active principle), fat, starch, gum, tannin, volatile oil, sugar.

FIG. 118.

*Cimicifuga racemosa*.

**Cimicifugin.**—Bitter, acrid crystalline principle; obtained by acting on the "Eclectic" resinoid, cimicifugin, or upon the fresh rhizome with alcohol, precipitating (resin, tannin, coloring-matter) with lead subacetate, removing lead with hydrogen sulphide, and evaporating; it is soluble in alcohol, chloroform, slightly in ether.

**Resins.**—There are two of these, one soluble in alcohol but not in ether, the other soluble in ether as well as alcohol. These two are obtained as a mixture by exhausting powdered drug with alcohol, precipitating with water, drying precipitate, and as such constitutes the "Eclectic" *cimicifugin* or *macrotin*, a yellowish-brown hygroscopic powder. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

PREPARATIONS. — 1.

*Fluidextractum Cimicifugæ.* Fluidextract of Cimicifuga. (Syn., Extractum Cimicifugæ Fluidum, U. S. P. 1890; Br. Extractum Cimicifugæ Liquidum; Fr. Extrait liquide d'Actée à Grappes. Ger. Flüssiges Cimicifuga-extrakt.)

*Manufacture:* Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose, Mv–30 (.3–2 Cc.).

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Prep.: 1. *Extractum Cimicifugæ*. Extract of Cimicifuga. (Syn., Extract of Black Cohosh; Fr. Extrait d'Actée à Grappes; Ger. Cimicifugaextrakt.)

*Manufacture*: Evaporate cautiously to dryness fluidextract of cimicifuga 100 Cc., reduce to powder, add powdered glycyrrhiza (peeled Russian) q. s. 25 Gm., mix thoroughly. Dose, gr. 1–8 (.06–.5 Gm.).

2. *Tinctura Cimicifugæ*. Tincture of Cimicifuga. (Syn., Br. Tinctura Cimicifugæ (Actææ); Fr. Teinture d'Actée à Grappes; Ger. Cimicifugatinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol q. s. 100 Cc. Dose, ʒss–1 (2–4 Cc.).

*Unoff. Preps.*: *Decoctum*, 5 p. c., dose, ʒss–1 (15–30 Cc.). *Compound Syrup*, 4 p. c. (+ glycyrrhiza 2, senega 2, ipecac 1, wild cherry 4), dose, ʒj–4 (4–15 Cc.).

**PROPERTIES.**—Alterative (diuretic, diaphoretic, expectorant), antispasmodic, sedative (arterial and nervous), safer than digitalis, emmenagogue. It acts on the gastric secretion like any other bitter, slightly depresses the rate, but increases the force of the pulse, like digitalis; contracts the uterus, increasing the menstrual flow and arterial tension.

**USES.**—It was introduced first into medicine, 1831, by Dr. Young. Given as cardiac tonic in fatty heart, chorea, acute and chronic bronchitis, rheumatism, neuralgia, hysteria, phthisis, dyspepsia, amenorrhœa, dysmenorrhœa, seminal emissions. Large doses cause vertigo, tremors, reduced pulse, vomiting, prostration. Once thought efficacious in snake bites, labor-pains, and ills of late pregnancy, but not now so considered.

*Incompatibles*: Iron preparations, stimulants, alcohol, ammonia.

*Synergists*: Gold, digitalis, ergot, belladonna, etc.

## STAPHISAGRIA. STAPHISAGRIA.

**Delphinium**  
**Staphisagria**, Linné. } The ripe seed.

*Habitat*. Mediterranean Basin; cultivated, France, Italy.

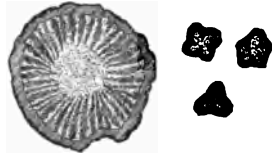
*Syn.* Stavesacre, Larkspur Herb, Semen Staphidis-agriæ, Semen Pedicularis; Br. Staphisagriæ Semina; Fr. Staphisaigre; Ger. Stephanskörner, Läusekörner.

**Del-phin'i-um**. Gr. *δελφίνιον*; L. *delphinus*, a dolphin—i. e., the form of the nectary resembles the imaginary figures of the dolphin.

**Staph-i-sag'ri-a**. L. fr. Gr. *σταφίς*, dried grape, raisin, + *ἀγρία*, wild—i. e., fruit clusters resemble wild grapes. *Staves'acre* is only a corruption.

**PLANT.**—Annual herb 1–1.3 M. (3–4°) high, branched, downy; root large, tapering; leaves 10–12.5 Cm. (4–5') broad; palmately 5–9-parted, with long, hairy petioles, lanceolate, pubescent segments; flowers purplish, racemes; pedicels long, stout, hairy; sepals petaloid; fruit 3, thick, oblong, erect, hairy, veined follicles with prolonged

FIG. 119.



*Cimicifuga racemosa*: transverse section through a branch of the rhizome and through rootlets; natural size.

curved beak, each follicle 12-seeded; odor of plant unpleasant. SEED, 5–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') long, 3–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') broad, irregularly tetrahedral, broadest side convex, blackish-brown, lighter with age, strongly reticulate, endosperm oily, enclosing small straight embryo; odor slight; taste intensely bitter, acrid. *Solvents*: alcohol; boiling water. Dose, gr. 1–2 (.06–.13 Gm.).

CONSTITUENTS.—Alkaloids 1 p. c.: Delphinine, Delphinoidine, Delphisine, Staphisagrine, Staphisagroine,  $C_{20}H_{24}NO_4$ , malic acid, fixed oil 25 p. c., volatile oil, (proteids, mucilage, ash 9 p. c.).

Delphinine,  $C_{22}H_{33}NO_6$ .—This leading alkaloid occurs as malate in white acrid crystals; obtained by boiling the decoction with magnesium oxide, treating precipitate with alcohol, evaporating. As such it consists of three distinct principles, one of resinous nature, separated from its solution in diluted sulphuric acid by adding nitric acid; another which is insoluble in ether (staphisagrine—staphisaine); the third soluble in alcohol, chloroform, ether, and considered pure delphinine. Dose, gr.  $\frac{1}{80}$ – $\frac{1}{10}$  (.001–.006 Gm.); this is made also into an ointment, 5 p. c., and a liniment, 5 p. c. with alcohol or olive oil as the base.

Delphinoidine,  $C_{12}H_{18}N_2O_7$ .—Amorphous, alkaline, soluble in alcohol, chloroform, ether; brownish-red with sulphuric acid.

Delphisine,  $C_{27}H_{46}N_2O_4$ .—Crystalline, soluble in alcohol, chloroform, ether; dark brown with sulphuric acid.

Staphisagrine, Staphisaine, or Staphisain,  $C_{22}H_{33}NO_5$ .—Amorphous, yellow, insoluble in ether, soluble in alcohol, chloroform; bitter, acrid, red and violet with sulphuric acid.

The fixed oil is extracted with ether or benzene, which also takes out delphinine at the same time. It is claimed that delphinine and delphisine have the same composition,  $C_{31}H_{49}NO_7$ , and that they crystallize alike from their ether or benzene solutions.

PREPARATIONS.—1. *Fluidextractum Staphisagriae*. Fluidextract of Staphisagria. (Syn., Fluidextract of Stavesacre Seed; Fr. Extrait liquide des Semences de Staphisaigre; Ger. Flüssiges Stephanskörner-extrakt.)

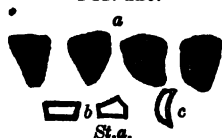
*Manufacture*: Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose,  $\mathfrak{Mj}$ –2 (.06–.13 Cc.).

*Unoff. Preps.*: Tincture, 10 p. c., dose,  $\mathfrak{Mv}$ –15 (.3–1 Cc.). Extract, dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.). *Unguentum Staphisagriae* (Br.), 20 parts + yellow wax 10, benzoinated lard 85.

PROPERTIES.—Diuretic, cathartic, emetic, rubefacient, poisonous.

USES.—The seeds were popular with the Greeks, Romans, etc., as emetic, cathartic, but are so dangerous as, in modern times, to be used chiefly externally for killing vermin, lice, itchmite; in rheumatism, neuralgia, earache, toothache, and for catching fish like cocculus indicus; they should never be applied to abrasions. When taken inter-

FIG. 120.



Stavesacre seed: a, natural size; b, cross-section; c, longitudinal section.

**RANUNCULACEÆ.**

nally cause lessened heart action and respiration, great weakness, loss of voluntary movement, then insensibility, frequent spasms, death from spinal-cord paralysis and asphyxia. Delphinine resembles closely aconitine and veratrine, irritating the skin, producing tingling and burning inflammation, even when applied as ointment or liniment.

**Poisoning:** Similar to aconite and veratrum; use emetics or pump, draughts of warm water, tannin, powdered charcoal, diffusible stimulants, keep patient quiet, feet elevated, extremities warm. To relieve spasms, inhale chloroform or give hydrated chloral (3ss; 2 Gm.), potassium bromide (3j-2; 4-8 Gm.). Use all haste, as death is chiefly by asphyxia.

**Allied Plants:**

1. *Delphinium Consolida*, *Field Larkspur*.  
—The seed, official 1820-1880. C. Europe, cultivated and naturalized in the United States. Plant .6-1 M. (2-3°) high, in grain fields, flowers beautiful blue, seed flattish, tetrahedral, 1-2.5 Mm. ( $\frac{1}{2}$ - $\frac{1}{10}$ ') broad, acute edges, testa black, pitted, inodorous, bitter, acrid, used for asthma, dropsy, wounds, ulcerated buboes; in tincture, 5 p. c. (diluted alcohol), fluidextract or decoction; poisonous.
2. *D. Aja'cis*, S. Europe, *D. urceola'tum* (*exalta'tum*), Penn., Minn., *D. carolinia'num* (*azu'reum*), Wis., Ark.—The first has the most dense flowers, the second is the tallest, the third has the lightest blue flowers; all three are cultivated.

FIG. 121.



*Delphinium Consolida.*

**ACONITUM. ACONITE.**

**Aconitum** } The dried tuberous root, collected in autumn, containing 0.5 p. c. of aconitine.  
**Napellus**, Linné. }

**Habitat.** Europe, Asia, N. America, Himalaya, Alps, Pyrenees Mountains, 3,300-4,800 M. (11,000-16,000°) elevation; cultivated in England, C. Europe.

**Syn.** Monkshood, Wolfsbane, Cuckoo's or Friar's Cap, Friar's Cowl, Wolfroot, Styrian Monkshood, Mousebane, Face-in-hood, Jacob's-chariot, Blue-rocked; Br. Aconiti Radix; Fr. Aconit, Coqueluchon; Ger. Tubera Aconiti, Aconitknollen, Eisenhut, Sturmhut.

**Ac-o-ni'tum.** L. fr. Gr. *ἐν*, on, + *ἀκόναις*, rock—i. e., it grows upon steep rocks in mountains; or fr. Fr. *Acone*, a town in Bithynia, where it grows plentifully.

**Na-pel'tus.** L. a little turnip; fr. *napus*, a turnip—i. e., mediæval name from shape of roots, once used generically.

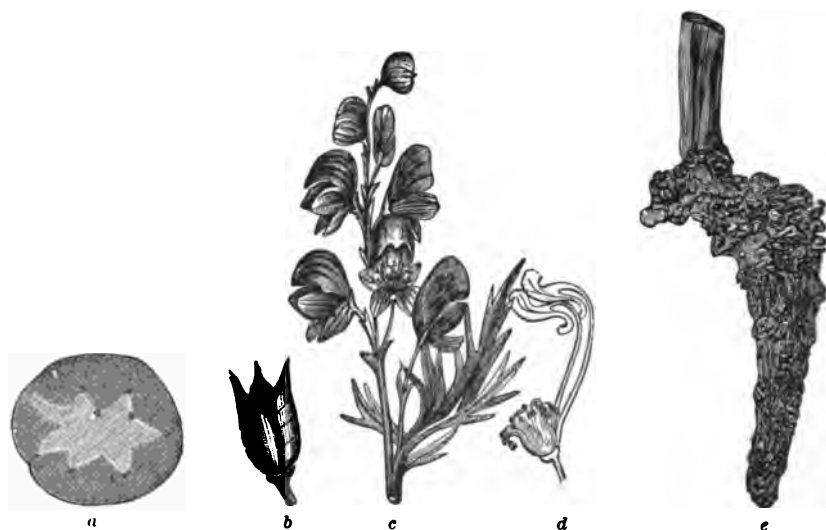
**PLANT.**—Perennial herb; stem .6-1.5 M. (2-4°) high, round, smooth, leafy; leaves 5-10 Cm. (2-4') broad, palmately 3-7-divided, dark green above, lighter below, smooth, shining, petiolate, divisions wedge-shaped, with 2-3 lobes extending midway; flowers July (third year), large, beautiful, violet-blue, on stem's summit, racemes, sepals petaloid, nectariferous; fruit, 3-5 pod-like capsules. Root, produced



at the end of a short rhizome, slenderly conical, 4–10 Cm. ( $1\frac{3}{4}$ –4') long, 10–20 Mm. ( $\frac{2}{5}$ – $\frac{4}{5}$ ') thick at the crown, longitudinally wrinkled, dark brown, marked with coarse whitish root-scars, fracture short, horny or mealy, bark thick; internally whitish or brownish, starchy, central axis (cambium zone) irregular 5–7-angled; odor slight; taste sweetish, acrid, producing a tingling sensation, numbness; powder yellowish-gray. *Solvent*: alcohol. *Dose*, gr. 1–2 (.06–.13 Gm.).

**ADULTERATIONS.** — Allied aconite roots (*A. variegatum*—much smaller, *A. Fischeri*—light gray, plump, smooth), defective roots, small horseradish roots (collected only when leaves absent, as by these they may easily be distinguished), yellowish externally, taste exceedingly

FIG. 122.



*Aconitum Napellus*: a, transverse section of tuber, b, fruit carpels; c, flowering branch; d, flower deprived of calyx, showing the only 2 peculiarly shaped petals, the 6 others almost aborted; e, tuber.

pungent, irritating; roots of European Masterwort (*Imperato'ria* (*Peuced'anum*) *Ostru'thium*), which closely resemble aconite root, but are aromatic, pungent, with oil-cells arranged in several circles, easily visible in cross-sections.

**Commercial.**—Plant is cultivated in gardens frequently for its ornamental flowers, and when these are fully expanded it is always well to collect the root; was introduced into medicine by Baron Störck, Vienna, 1762, but was known to the ancients as a powerful poison, in which all parts of the plant strongly share; by cultivation becomes stronger, and it is this the Br. P. requires, collected in autumn. It is mostly supplied and imported from Germany (England, France, Switzerland, India) in packages, bales, etc.

**CONSTITUENTS.**—Four alkaloids (one crystalline, three amorphous) 0.24–0.62–1.15 p. c.: Aconitine (crystalline), Piceaconitine (benzacon-

**RANUNCULACEÆ.**

ine, isaconitine),  $C_{25}H_{39}NO_{11}$ , Aconine, Pseudoaconitine (napelline),  $C_{33}H_{45}NO_{12}$ , aconitic acid,  $H_3C_6H_3O_6$ , starch, resin, fat, sugar, mannite.

**Aconitina, Aconitine**,  $C_{34}H_{47}NO_{11}$ , *official*.—(Syn., Napaconitine, Aconitia; Fr. Aconitine; Ger. Aconitin.) Exists in combination with aconitic acid, and is obtained by exhausting root with cold rectified fusel oil, shaking resulting tincture with diluted (1 p. c.) sulphuric acid, adding chloroform to remove resin, rendering alkaline with sodium carbonate, shaking out with ether. It is in white rhombic tables or prisms, bitter, odorless, permanent, producing tingling sensation to tongue, lips, soluble in chloroform, 22 parts alcohol, 44 ether, 5.6 benzene, 3,200 water, melts with decomposition at  $195^{\circ} C.$  ( $383^{\circ} F.$ ), no residue, forms many salts, as hydrochloride, nitrate, sulphate, etc.; commercial aconitine is only six- to nine-tenths pure, it being a mixture of the various alkaloids, consequently to that extent is less poisonous than when genuine. *Tests*: 1. Dissolved in diluted phosphoric acid and evaporated gives violet color. 2. Dilute solutions precipitate with mercuric potassium iodide T. S., tannic acid T. S., gold chloride T. S., concentrated solutions with platinic chloride T. S., mercuric chloride T. S., picric acid T. S. 3. Yellow residue from evaporating 0.01 Gm. + 5 drops nitric acid, when cooled should not yield violet color with alcoholic potassium hydroxide T. S. (dif. from pseudoaconitine, atropine). Dose (crystals), gr.  $\frac{1}{64}$ – $\frac{1}{200}$  (.0001–.00035 Gm.); (amorphous), gr.  $\frac{1}{64}$ – $\frac{1}{200}$  (.001–.003 Gm.).

**Aconine**,  $C_{26}H_{41}O_{11}$ .—This appears antagonistic to aconitine in cardiac effect; picroaconitine is considered inert; aconitic acid is abundant, but is chiefly in combination with calcium, and is almost inert.

**Assay**: Exhaust the drug with mixture of alcohol (7) and water (3), evaporate resulting percolate to dryness, dissolve in  $\frac{N}{10}$  sulphuric acid V. S., and distilled water, render filtrate alkaline with ammonia water, shake out with ether 25, 15, 10, 10, evaporate ethereal solutions to dryness, dissolve residue in  $\frac{N}{10}$  sulphuric acid V. S., titrate excess of acid with  $\frac{N}{50}$  potassium hydroxide V. S., using hematoxylin T. S. indicator; divide Cc. of  $\frac{N}{50}$  potassium hydroxide V. S. used by 5, subtract this from 3, multiply remainder by 0.064, and product by 10, or from amount of  $\frac{N}{10}$  sulphuric acid V. S. found to have been neutralized by the alkaloidal principle the p. c. present in the drug is calculated—each Cc.  $\frac{N}{10}$  sulphuric acid V. S. corresponding to 0.064 Gm. of aconitine.

**PREPARATIONS**.—1. *Fluidextractum Aconiti*. Fluidextract of Aconite. (Syn., Extractum Aconiti Fluidum, U. S. P. 1890; Fr. Extrait liquide de Racine d'Aconit; Ger. Flüssiges Aconitknollenextrakt).

**Manufacture**: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.4 Gm. of aconitine. **Assay**: Evaporate 10 Cc. to dryness, and proceed approximately as in assay of aconite. Dose,  $\mathcal{M}_{ss}$ —2 (.03–.13 Cc.).

2. *Tinctura Aconiti*. Tincture of Aconite. (Syn., Fr. Teinture de Racine d'Aconit; Ger. Aconittinktur, Eisenhuttinktur.)

**Manufacture**: 10 p. c. Macerate, percolate 10 Gm. with alcohol 70 p. c., q. s. 100 Cc.; when assayed each 100 Cc. should contain 0.045

Gm. of aconitine. *Assay*: Evaporate 100 Cc. to dryness and proceed approximately as in assay of aconite; this is considered the best preparation for internal use. Dose, Mss-10 (.03-.6 Cc.)

FIG. 123.

*Aconitum Napellus*: leaf, small sized.

*Unoff. Preps.*: *Extract* (alcohol), dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.01–.02 Gm.). *Abstract* (alcohol), dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.). *Tincture Aconite Leaves*, 8 p. c. (diluted alcohol), dose, Mj-6 (.06–.4 Cc.). *Fleming's Tincture Aconite Root*, 70 p. c. (alcohol), dose, Mss-4 (.03–.26 Cc.). *Glycerite*. *Plaster*. *Pseudoaconitine* (*A. ferox*), dose, gr.  $\frac{1}{100}$ – $\frac{1}{1000}$  (.00026–.00065 Gm.). *Oleate of Aconitine*, 2 p. c. *Linimentum Aconiti* (Br.), 50 Gm. + camphor 2.5, alcohol q. s. 70.5 Cc. *Unguentum Aconitinæ* (Br.), 2 p. c.

**PROPERTIES.**—Sedative (heart and nerve), anodyne, diaphoretic, antipyretic, myotic, poisonous. Produces tingling and numbness of the lips, mouth, and fingers; increases the secretion of the kidneys, salivary glands, and skin; circulation (heart action, pulse) becomes weak and slow, due to direct depression of heart-muscle, and stimulation of pneumogastric nerve; respiration (breathing) shallow and slow; temperature is lowered, all causing a tendency to fainting when in the erect position, and giving rise to its popular name "therapeutic lancet"; it paralyzes first the sensory and then the motor nerves.

**USES.**—It should never be given in asthenic or debilitated conditions, or when the heart action is weak, or in gastric catarrh, but may be employed in all sthenic or inflammatory fevers of the young and vigorous; croup, laryngitis, pharyngitis, tonsillitis, acute meningitis, peritonitis, pleuritis, rheumatism; measles, scarlet fever, erysipelas, first stage of pneumonia, pericarditis and pleurisy, nervous heart palpitation, cardiac hypertrophy. Locally on non-abraded surfaces; neuralgia, rheumatism, sciatica, herpes zoster, chilblains, pruritus, odontalgia, periodontitis, inflamed pulps.

**Poisoning**: Have anxious countenance, pallid, clammy skin covered with cold sweat; pulse and respiration slow, weak, and irregular; muscular weakness, loss of sight and hearing, pupils either normal, contracted or dilated, general anæsthesia, collapse, death from syncope, or respiratory paralysis, sometimes preceded by convulsions; conscious until near the end, when carbon dioxide narcosis sets in. Evacuate stomach reclining, direct recumbent position, feet elevated, warmth to extremities, give diffusible cardiac stimulants (brandy, whisky, alcohol, ether, ammonia) by the stomach, rectum, or skin, then digitalis, tannin; artificial heat and respiration (rhythmically raising and lowering arms from straight at sides to up over head and back again 20 times per minute), amyl nitrite, atropine, and strychnine (hypodermically) to stimulate heart and respiration.

# **RANUNCULACEÆ.**

*Incompatibles:* Ammonia, alcohol, alkalies, atropine, digitalis, ether, morphine, heat, turpentine.

*Synergists:* Veratrum, pulsatilla, staphisagria, cold, fatigue.

Leaves, official 1820–1880. These are considered 5–20 times weaker than the root, yet many specimens yield considerable alkaloids; their uncertainty and deception have led to disuse, but if collected when flowers are two-thirds in bloom they are reliable; it is then that all nutrient constituents are in demand for the perfection of reproductive organs, thus leaving behind in the leaves a goodly quantity of the (waste products) alkaloids. Dose, gr. 1–4 (.06–.26 Gm.).

## *Allied Plants:*

1. *Aconitum neomontana* num.—Leaves, official 1820–1840, and *A. paniculatum*, leaves, official 1840–1850, possess very little acidity, but even now their roots are collected and mixed with the official.

2. *A. Cammarum* (*variegatum*).—Europe; root globular, ovate, 12 Mm. ( $\frac{1}{2}$ ') long, pith rays 5, short, rounded; and *A. Störckia* num, Europe; root conical, slender, pith roundish pentagonal, similar in effect, smaller than, but often found mixed with the official.

3. *A. ferox*.—India aconite (native Bikh or Bish) is the strongest species, with root 5–10 Cm. (2–4') long, 2.5 Cm. (1') thick, conical and brown; yields pseudaconitine (peraconitine), similar to and as active as aconitine; *A. uncinatum* and *A. luridum* roots are collected with this, as they all have constituents similar to the official, but here pseudaconitine predominates.

4. *A. Fischeri* and *A. japonicum*, Japanese and Chinese Aconite.—Roots napiform, long, pith circular, 5–7-rayed; yields japaconitine, identical with aconitine; allied to former is *A. columbiana* num; Rocky Mountains; poisonous.

5. *A. heterophyllum*.—India—fusiform, conical, bitter, not acrid or poisonous, *A. Anthora*, Europe—fusiform, long, pith thin, rays short and long, and *A. Lycocotum*, Europe, N. Asia—rhizome oblique, several-headed, bitter.

6. *Pulsatilla* (*Anemone*) *Pulsatilla* and *Pulsatilla* (*Anemone*) *pratensis*, *Pulsatilla*.—The herb, collected soon after flowering, official 1880–1900; Europe (England, Siberia). Perennial herbs, 10–25 Cm. (4–10') high, covered with soft, silky hairs; stems erect, simple, scape bearing a large terminal, bell-shaped, purplish flower having 6 sepals, 2.5–4 Cm. (1–1 $\frac{3}{8}$ ') wide; fruit achene, numerous, short-beaked; root, several-headed; leaves radical, pinnately-cleft; inodorous, very acrid, and owing to volatility of anemonin (chief constituent) should not be kept longer than one year; contains anemonin, acrid anemone camphor, iso-anemonic acid,  $C_{15}H_{14}O_7$ . Sedative, anodyne, mydriatic, diuretic, diaphoretic, emmenagogue, expectorant, vesicant, emetic, poisonous—similar to aconite, causing tingling, numbness, reducing respiration, temperature, cardiac and arterial tension, paralysis of motion and sensation; dysmenorrhœa, bronchitis, asthma, whooping-cough, gastritis, epididymitis, orchitis, conjunctivitis, eczema, ulcers, meningitis. *Poisoning*—Symptoms and treatment similar to aconite. Dose, gr.

1-5 (.06-.3 Gm.; extract (expressed juice + alcohol, gr.  $\frac{1}{2}$ -3 (.03-.2 Gm.); tincture, 50 p. c.,  $\mathfrak{M}$   $\frac{1}{10}$ -10 (.006-.6 Cc.); Homeopathic tincture (extract); anemonin, gr.  $\frac{1}{4}$ - $\frac{3}{4}$  (.016-.05 Gm.).

7. *P. hirsutis'sima* (*Anemone pa'tens* var. *Nuttallia'na*).—Herb, official 1880-1890, W. N. America; flowers whitish, purplish, sepals 5-7,—2.5-4 Cm. ( $1-1\frac{3}{8}'$ ) long, developed before the leaves. *A. quinque-*

FIG. 124.

*Pulsatilla* (*Anemone*) *Pulsatilla*.

FIG. 125.

*Pulsatilla* (*Anemone*) *pratensis*.

*fo'lia* (*nemoro'sa*), *Wood Flower*, *Wood Anemone*, N. America; flowers purplish-white. *A. corona'ria*, *A. sylves'tris*, and *A. ranunculoi'des*, Levant, Asia, Europe; all are acrid and deteriorate upon drying.

FIG. 126.

*Hepatica Hepatica* (*triloba*): leaf showing venation.

FIG. 127.

*Ranunculus* in bloom.

8. *Hepat'ica Hepatica* (*tri'loba*), *Noble Liverwort*.—The leaves, official 1830-1880, N. America, Europe. One of our earliest harbingers of spring; acaulescent perennial, flowers April, bluish, leaves reniform, 5 Cm. (2') long, 3-lobed; contains mucilage, tannin. Used as tonic,

**BERBERIDACEÆ.**

demulcent, deobstruent, for liver affections, bronchitis, phthisis; in decoction, infusion. Dose, 3ss–2 (2–8 Gm.).

9. *Ranunculus bulbosus*, *Bulbous Buttercup*.—The corm and herb, official 1820–1880, Europe, N. America. Plant hairy, 15–45 Cm. (6–18') high, bulb at stem base, flowers May, yellow, 5's; contains volatile oil (anemonin + anemonic acid). Used as irritant, diuretic, narcotic; externally in bronchitis, rheumatism, sciatica; in decoction, infusion. Dose, 3ss–1 (2–4 Gm.).

**28. BERBERIDACEÆ. Barberry Family.**

*Ber-be-ri-da'se-e*. L. *Berber(is)id* + *aceæ*, fr. *Berberys*—i. e., Arabic name of the fruit. Shrubs, herbs with watery juice. Distinguished by few stamens (same number as petals and opposite them) in 2–3 whorls, anthers opening by 2-hinged valves (Podophyllum, longitudinal, as in Ranunculaceæ); leaves usually with spiny teeth, sometimes reduced to spines or barbs, hence the name *barberry*; sepals and petals in 2 rows, 3 each, imbricate; ovary 1-celled, superior; temperate climates, tropics; cathartic, astringent, bitter, acrid (oxalic), yellow dye.

Genera : 1. *Berberis*. 2. *Podophyllum*.

**BERBERIS. BERBERIS.**

***Berberis Aquifolium*, Pursh, }** The rhizome and roots.  
and other species.

*Habitat*. United States—W. Nebraska, Oregon, Rocky Mountain region, extending to Arizona and British Columbia.

*Syn*. Oregon Grape, Rocky Mountain Grape, Holly-leaved Barberry, California Barberry, Trailing Mahonia.

*Ber'be-ris*, L. see etymology, above, of Berberidaceæ.

*A-qui-fo'li-um*. L. *acus*, needle, + *folium*, leaf—name assigned the holly from the spiny leaf-margins—i. e., leaves of this plant resemble those of the holly.

**PLANT**.—Low-trailing glabrous shrub; leaves petioled, pinnate, leaflets 3–7, ovate, acute, truncate or cordate base, sessile, thick, persistent, dentate with spine-bearing teeth, flowers April–May, yellow, racemes; fruit globose berry, blue, resembling whortleberry. **RHIZOME**, in more or less knotty, irregular pieces of varying length, 3–20 Mm. ( $\frac{1}{8}$ – $\frac{4}{5}$ ') thick, with small pith, bark  $\frac{1}{2}$ –2 Mm. ( $\frac{1}{50}$ – $\frac{1}{12}$ ') thick, brownish; wood yellowish, radiate with narrow medullary rays, hard, tough; odor distinct; taste strongly bitter; pieces without bark should be rejected. *Solvent*: diluted alcohol. Dose, gr. 10–30 (.6–2 Gm.).

**ADULTERATIONS**.—Stem, which is a lighter yellow, outer surface ragged with more elongated scales or strips of partly detached cork.

**CONSTITUENTS**.—Berberine 2.35 p. c., Oxyacanthine 2.82 p. c., berbamine, gum, resin, tannin, phytosterin, fat.

**Berberine** (*Xanthopicrit*),  $C_{20}H_{17}NO_4$ .—This occurs in yellow bitter crystals, needles, prisms, soluble in alcohol, 300 parts water, insoluble in ether, golden-yellow salts slightly soluble in water.

**Oxyacanthine** (Berbine, Vinetine),  $C_{18}H_{19}NO_3$ .—This occurs in bitter white crystals, alkaline, turning yellow in sunlight, soluble in ether, 30 parts alcohol, slightly in water.

**PREPARATION.**—1. *Fluidextractum Berberidis*. Fluidextract of Berberis. (Syn., Fluidextract of Barberry; Fr. Extrait liquide Berberide (d'Epine-vinette); Ger. Flüssiges Berberitzenextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\times$ –30 (.6–2 Cc.).

**PROPERTIES.**—Alterative, anti-syphilitic, diuretic, antiperiodic, tonic, laxative.

**USES.**—Scrofulous and syphilitic cachexia, chronic skin diseases—psoriasis, eczema, chronic uterine diseases, atonic dyspepsia with constipation, chronic hepatitis.

**Allied Plant:**

1. *Berberis vulgaris* (*canadensis*).—The fruit, official 1830–1840; the bark of root, 1860–1880. Spreading shrub, 1–2 M. ( $3-6^\circ$ ) high, thorny branches, bark gray, wood yellow, leaves toothed, spiny;

flowers June, yellow, racemes; berries oval, scarlet; root-bark yellowish-gray, separable into laminae, bitter, astringent; contains berberine, fat, resin, tannin, oxyacanthine, berbamine; fruit has malic and citric acids, tannin. Used in febrile diseases, diarrhoea; bark for dysentery, dropsy, dyspepsia, to lessen size of spleen, much like calumba. Dose of bark, gr. 2–10 (.13–.6 Gm.); in infusion, decoction. Fruit juice sometimes made into syrup, preserves, etc.



*Berberis vulgaris* (*canadensis*).

## PODOPHYLLUM. PODOPHYLLUM.

**Podophyllum** } The dried rhizome.  
**peltatum**, Linné. }

**Habitat.** N. America (Canada, United States), in rich woods, thickets.

**Syn.** May Apple, American or Wild Mandrake, Raccoon or Yellowberry, Ground or Wild Lemon, Hog, Indian or Devil's Apple, Duck's Foot, Umbrella Plant, Vegetable Mercury (Calomel); Br. Podophylli Rhizoma; Fr. Rhizome de Podophyllum; Ger. Fussblattwurzel.

**Pod-o-phyllum.** L. fr. Gr. *podōs*, foot, + *φύλλον*, leaf—i. e., its 5–7-parted leaf resembles the foot of aquatic birds or domestic fowls, as ducks, etc.

**Pel-ta'tum.** L. *peltatus*, having a pelta or light shield—i. e., petioles attached to the middle of the lamina instead of to the margin.

**May apple**—i. e., plant blooms in May, thus starting the fruit, which ripens in summer (August).

**PLANT.**—Perennial herb; stem .3 M. ( $1^\circ$ ) high, pale green, divides near the summit into 2 petioles, each bearing a palmately 5–7-deeply-

**BERBERIDACEÆ.**

lobed, peltate leaf 10–15 Cm. (4–6') wide, segments wedge-shaped, coarsely toothed at their ends, glaucous-green, petioles 7.5 Cm. (3') long; flowers May, borne at fork of petioles, single, nodding, white 5 Cm. (2') broad, 6–9 petals, 12–18 stamens; fruit yellowish berry, 2.5–5 Cm. (1–2') long, ovoid, fleshy, soft, indehiscent; seeds about 12; often eaten by animals, hence some of its names. RHIZOME, of horizontal growth, creeping, subcylindrical, flattened above, 1.3–2 M. (4–6°) long (in shops as fragments, 2.5–20 Cc. (1–8') long, 5 Mm. ( $\frac{1}{5}$ ') thick, consisting of joints or annual sections 5–10 Cm. (2–4') long,

FIG. 129.

*Podophyllum peltatum.*

the internodes 2–8 Mm. ( $\frac{1}{12}$ – $\frac{1}{3}$ ') thick, nodes annulate, 12 Mm. ( $\frac{1}{2}$ ') thick, the upper surface marked by large cup-shaped stem-scars, the lower with numerous root-scars or remains of roots, fracture short, its surface mealy or horny, whitish to pale brown, with circle of small wood-bundles, large pith; odor slight, more pronounced and characteristic in the powder; taste sweetish, disagreeably bitter, acrid; powder yellowish-gray. Should collect rhizome in Aug.–Sept., soon after the leaves fall off. Solvents: alcohol; boiling water partially. Dose, gr. 5–15 (.3–1 Gm.).

**ADULTERATIONS.**—Owing to similarity of leaves, collectors often



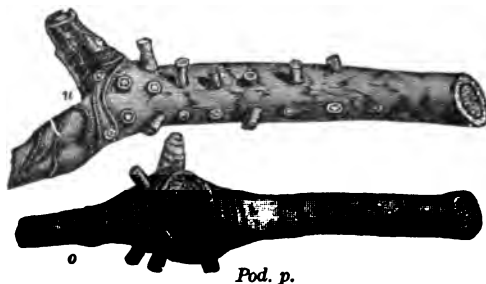
include sanguinaria, which, in spite of usual greater value, occurs to the extent of 2-3 p. c.; in the same quantity geranium frequently is found, with less amount of comfrey.

*Commercial.*—Plants of 50 or more grow in clusters or patches of rounded or irregular shape, 3-6 M. (10-20°) broad, near wood-borders, fence-panels, or in the open, preferably on heavy soil; the rhizomes and roots containing much resin are surprisingly heavy, considering their appearance, and break with an elastic but short fracture, giving more or less noise; the trade recognizes the drug often by the names: *thick, thin, heavy, light*, which chiefly has reference to physical characteristics. The fall collection always is preferred, as it is heavier, from abundance of resin, and breaks with a cleaner fracture.

**CONSTITUENTS.**—Resin 4-5 p. c., starch, gum, fixed oil, gallic acid.

**Resin (Resina Podophylli, Podophyllin).**—This is a complex substance consisting of: (1) *podophyllotoxin*,  $C_{15}H_{14}O_6$ , 40-60 p. c.,

FIG. 130.



Podophyllum: u, under side; o, upper side.

which is obtained after removing the fat with benzoin, by precipitating the podophyllinic acid from a chloroformic solution of the resin or rhizome, by the addition of ether and then simply evaporating the ethereal solution; this is the cathartic principle, being whitish, bitter, resinous, crystallizable, soluble in chloroform, ether, acetone, alcohol; cherry-red, then greenish-blue and violet by sulphuric acid, when heated with alkalis is converted by hydration into podophyllinic acid,  $C_{15}H_{16}O_7$ , which readily loses water, forming crystalline pieropodophyllin (inactive, isomeric with podophyllotoxin); (2) *podophyllinic acid*, which is an inactive resin-acid, insoluble in ether, but soluble in chloroform or alcohol, and obtained by the above process for podophyllotoxin (being precipitated and left behind upon the addition of ether). The color is due to *podophylloquercetin*, which occurs in yellow needles, insoluble in water, slightly in chloroform, more so in ether, freely in alcohol. The small amount of uncrystallizable resin, *podophylloresin*, is also purgative.

**PREPARATIONS.**—1. *Fluidextractum Podophylli*. Fluidextract of Podophyllum. (Syn., Extractum Podophylli Fluidum, U. S. P. 1890,

**BERBERIDACEÆ.**

Fluidextract of May Apple or Mandrake; Fr. Extrait liquide de Podophylle; Ger. Flüssiges Fussblattwurzelextrakt.)

*Manufacture:* Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose, ℥v-30 (.3-2 Cc.).

2. *Resina Podophylli.* Resin of Podophyllum. (Syn., Fr. Résine de Podophylle; Ger. Podophyllumharz.)

*Manufacture:* Macerate, percolate 100 Gm. with alcohol q. s. 160 Cc., distil off alcohol until residue consistency of thin syrup, which, with constant stirring, add to water 100 Cc. + hydrochloric acid 1 Cc., wash, dry. It is an amorphous powder, pale greenish-yellow, darker on exposure to heat or light, slight peculiar odor, faintly bitter taste, irritating to mucous membrane (eyes, etc.), soluble in alcohol, 75 p. c. soluble in ether, 65 in chloroform, 25 in boiling water. *Tests:* 1. At least 99 p. c. soluble in alcohol, giving a clear or slightly opalescent solution, faintly acid; solution in potassium or sodium hydroxide, reprecipitated by acids; ash 0.7 p. c. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{8}$ -1 (.008-.06 Gm.).

*Prep.: 1. Pilulæ Podophylli, Belladonnæ et Capsici.* Pills of Podophyllum, Belladonna and Capsicum. (Syn., Squibb's Podophyllum Pills; Fr. Pilules de Podophyllum, de Belladonne et de Poivre de Guinée; Ger. Podophyllum, Belladonna und Spanisch-Pfefferpillen.)

*Manufacture:* Triturate together resin of podophyllum 1.6 Gm., capsicum 3.2, sugar of milk 6.5, acacia 1.6, incorporate extract of belladonna leaves .8, glycerin and syrup equal parts q. s. 100 pills. Dose, 1-3 pills.

*Unoff. Preps.: Extract* (alcohol 80 p. c.), dose, gr. 5-10 (.3-.6 Gm.). *Abstract* (alcohol), dose, gr.  $\frac{1}{4}$ -2 (0.16-.13 Gm.). Pure Podophyllo-toxin, dose, gr.  $\frac{1}{12}$ - $\frac{1}{8}$  (.005-.008 Gm.). *Tinctura Podophylli* (Br.), 3.65 p. c. of resin in alcohol, dose, ℥v-15 (.3-1 Cc.).

**PROPERTIES.**—Hydragogue cathartic, cholagogue, alterative, irritant, tonic—slowest acting official purgative. Increases intestinal secretion, bile-flow, causes copious watery stools, griping, nausea in from 10-20 hours, acts mainly on the duodenum, but is a powerful intestinal irritant, resembling jalap and calomel, only slower; large doses are distinctly poisonous, producing in the young vomiting, purging, collapse, coma, finally epileptiform convulsions. Those employed in powdering the drug have irritation of the eyes, nose, mouth, respiratory passages, and skin. The resin applied to ulcers produces purgation and is also a powerful irritant to the skin. Its action upon the liver, being somewhat similar to that of mercury, early led some to claim for it alterative properties equal to those of that metal, and for a time it was employed under the name of "vegetable calomel" in those diseases for which mercury is a recognized specific; now, however, it is believed to have incidentally only very slight alterative power, and to possess no property in common with mercury save that of catharsis.

**USES.**—Constipation, torpid liver, lead costiveness, diarrhæa, catarrhal or malarial jaundice, remittent fevers, dyspepsia, bilious vomit-

ing, and headache. With cream of tartar useful in dropsies, rheumatic, scrofulous, and syphilitic affections; should be associated with hyoscyamus or belladonna to overcome griping, and, owing to extremely slow action, should not be given in combination with brisk cathartics, but preferably with such as act in approximately the same time, as calomel, jalap, aloes, leptandra, etc.—gr. 5 (.3 Gm.) of podophyllin (resin) have killed, so have ziss (6 Gm.), but in one case gr. 10 (.6 Gm.) failed to produce more than abdominal pains.

*Allied Plants:*

1. *Podophyllum Emo'di*.—Himalaya Mountains. Rhizome cylindrical; stem-scars crowded above, many roots below; yields resin 10–12 p. c., which contains 56 p. c. podophyllotoxin. Dose of resin, gr.  $\frac{1}{8}$ –1 (.008–.06 Gm.). This is very similar to, but stronger than our official drug.

2. *Caulophyllum thalictroides*, *Blue Cohosh*.—The rhizome and roots, collected in spring or early summer, official 1880–1900. N. America (Canada, United States). Perennial herb; stem .6 M. (2°) high, smooth, with large triternately compound leaf at summit; leaflets 3–5-lobed; flowers greenish-yellow. Rhizome horizontal, 10 Cm. (4') long, 8 Mm. ( $\frac{1}{8}$ ') thick, knotty from concave stem-scars on upper surface, grayish-brown, tough, woody; roots many, matted, 12.5 Cm. (5') long, 1 Mm. ( $\frac{1}{16}$ ') thick; contains caulophylline, caulophyllin (resins) 12 p. c., saponin, tannin. Antispasmodic, diuretic, emmenagogue, demulcent, sternutatory, sedative, oxytocic; hysteria, amenorrhœa, spasmodic dysmenorrhœa, uterine subinvolution (causing muscular contraction), arrests or produces abortion; the aborigines believed the infusion their best parturient, drinking it for several weeks prior to labor. Dose, gr. 10–30 (.6–2 Gm.); fluidextract, Mx–30 (.6–2 Cc.); extract, gr. 2–5 (.13–.3 Gm.); tincture, 25 p. c., 3j–2 (4–8 Cc.); decoction, infusion, both 5 p. c., 3j–2 (30–60 Cc.).

## 29. MENISPERMACEÆ. Moonseed Family.

Men-i-sper-ma'se-e. L. *Menispermum* + acœ, fr. Gr.  $\mu\acute{\eta}\nu\eta$ , the moon, +  $\sigma\pi\acute{\epsilon}\rho\mu\alpha$ , a seed—i. e., fruit (seed) kidney- or crescent-shaped. Shrubs, woody climbers or herbaceous vines; leaves exstipulate, alternate; flowers dioecious; sepals 4–12; petals 6, similar, usually in 2 rows, imbricate; stamens mostly 6; fruit drupe, superior; species very heteromorphous; embryo horseshoe-shaped; albumin scanty; tropics; bitter, narcotic, tonic, poisonous.

Genera: 1. *Chondrodendron*. 2. *Jateorhiza*.

## PAREIRA. PAREIRA.

*Chondrodendron tomentosum*, Ruiz et Pavon. } The dried root.

*Habitat.* Brazil (near Rio Janeiro, and in other parts), Peru.

*Syn.* Pareira Brava, Velvet Leaf; Br. Pareira Radix, Pareira Root; Fr. Butua; Ger. Grieswurzel, Pareirawurzel.

*Chon-dro-den'dron.* (Gr.  $\chi\acute{o}\nu\delta\rho\omicron\varsigma$ , a granule, +  $\delta\acute{\epsilon}\nu\delta\rho\omicron\nu$ , a tree—i. e., from the warty protuberances on the bark.

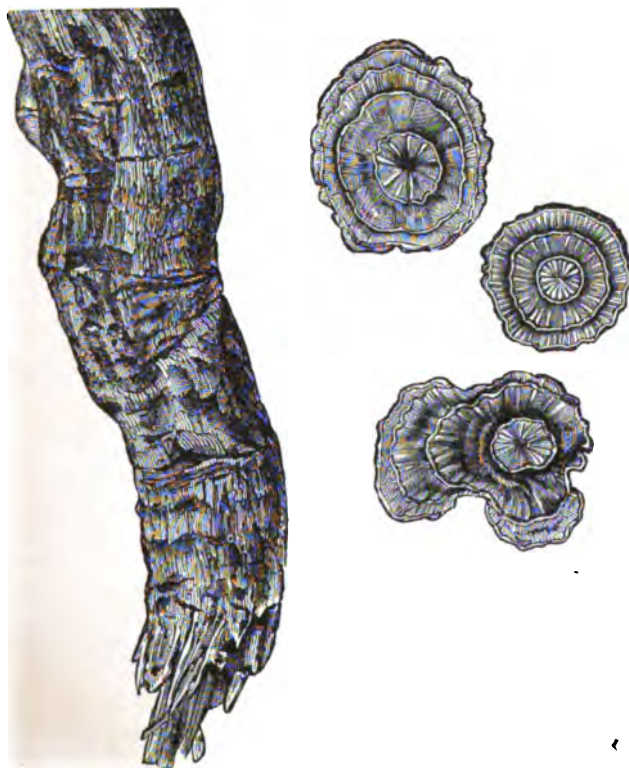
**MENISPERMACEÆ.**

**To-men-to'sum.** *L. tomentosus*, fr. *tomentum*, woolly—i. e., under side of the leaves having gray hairs.

**Pa-rei'ra (bra'va).** Port. fr. *parreira*, vine, + *brava*, wild—i. e., from its habit and the appearance of its bunches of fruit.

**PLANT.**—Tall, woody twiner, called natively *Abutua*; stem 1–10 Cm. ( $\frac{2}{3}$ –4') thick, bark rough, covered with elevated, elongated prominences; leaves 12.5–30 Cm. (5–12') long, on long petioles, ovate, cordate, upper surface smooth, under surface covered with close, fine wool of ashy hue; flowers dioecious, small, panicles; fruit purplish-black, drupes, 6 in a bunch like grapes, each 2.5 Cm. (1') long, ovoid,

FIG. 131.



Pareira (brava): portion of a root and transverse section of the same.

**1-seeded.** Root, in subcylindrical, tortuous pieces, 10–15 Cm. (4–6') long, 1–6 Cm. ( $\frac{2}{3}$ –2 $\frac{2}{3}$ ') thick, blackish-brown, transverse ridges, fissures, longitudinal furrows, hard, heavy, tough, when freshly cut having waxy lustre, internally yellowish or brownish-gray, the dried transverse section exhibiting 2 or more inequilaterally concentric circles of interrupted, porous wood-wedges (usually 12) projecting beyond the markedly retracted intervening tissue of large medullary rays; odor slight; taste bitter; turns inky bluish-black with tincture of iodine. Bright yellow pieces or those having gray wood, which is hard and

nearly tasteless, should be rejected. *Solvents*: alcohol (70 p. c.); boiling water. Dose, 3ss–1 (2–4 Gm.).

**ADULTERATIONS.**—*Roots of*: 1. Common pareira brava (*Cissampelos pareira*). 2. Thick false pareira brava. 3. Thin false pareira brava. These have been imported largely and used for the true; they are eccentric and have no waxy internal appearance. 4. White pareira brava (*Abuta rufescens*). This is concentric, medullary rays dark, interradian spaces white and rich with starch, called natively *Butua*. 5. Yellow pareira brava (*Abuta amara*), also eccentric, wood yellow. 6. *Stems* of the official and any of the above-mentioned plants, recognized by being more woody, lighter in color, and having distinct central pith; taste and virtues, however, are similar.

**CONSTITUENTS.**—Pelosine 0.5 p. c., tannin, starch, gum, ash 6–11 p. c.

**Pelosine** (*Cissampeline*),  $C_{18}H_{21}NO_3$ .—Identical with beberine (*Nectandra Rodiei*), buxine (*Buxus sempervirens*), and paricine; it is obtained by boiling the root in acidulated ( $H_2SO_4$ ), water and precipitating with potassium carbonate; purified by dissolving in water with sulphuric acid, treating with charcoal, precipitating anew with potassium carbonate, and then treating with ether; it is an amorphous, yellowish-brown, odorless powder, soluble in alcohol, ether, diluted acids.

**PREPARATIONS.**—1. *Fluidextractum Pareiræ*. Fluidextract of Pareira. (Syn., Extractum Pareiræ Fluidum, U. S. P. 1890; Br. Extractum Pareiræ Liquidum; Fr. Extrait liquide de Pareira Brava; Ger. Flüssiges Pareiraextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 60 Cc., glycerin 10, water 30, finishing with alcohol 60 p. c., q. s., evaporate to 100 Cc. Dose, 3ss–1 (2–4 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 10–20 (6–13 Gm.). *Infusion* (U. S. P. 1870, 6 p. c.), dose, 3j–2 (30–60 Cc.). *Decoction*, 5 p. c., dose, 3j–2 (30–60 Cc.).

**PROPERTIES.**—Diuretic, tonic, laxative. Similar to uva-ursi and chimaphila; it is eliminated by the kidneys, and in passing over the tract acts as a tonic and soother, especially on the bladder.

**USES.**—Cystitis, calculous affections, chronic inflammation and ulceration of the kidneys, gonorrhœa, leucorrhœa, dropsy, rheumatism, jaundice, inflammation of the urinary passages. Used natively for bites of poisonous serpents, the vinous infusion being taken internally and the bruised leaves applied to the wound.

*Incompatibles*: Ferric and lead salts, tincture of iodine.

*Allied Plants*:

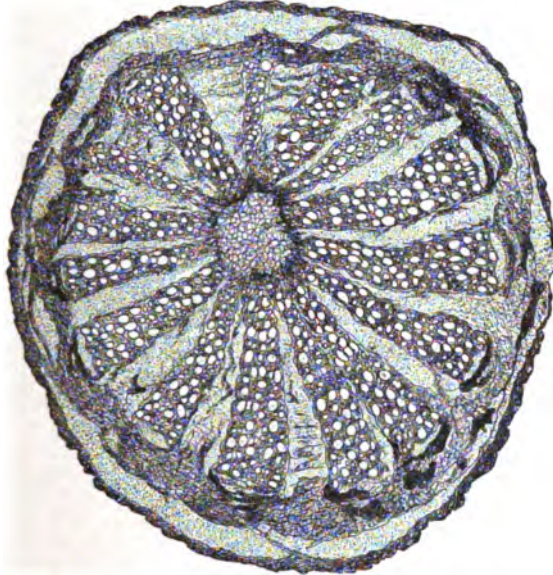
1. *Cissampelos pareira* (Gr. *κισσός*, ivy, + *ἀμπέλως*, a vine).—W. Indies, C. America. Root and stem 6–25 Mm. ( $\frac{1}{4}$ –1') thick, not concentric, wood in 20 porous wedges, separated by narrow medullary rays, bark brownish-gray, suberous; lighter than the official, non-waxy, and the infusion gives no blue color with tincture of iodine.

2. *Menispermum canadense*, *Yellow Parilla*, *Canadian Moonseed*.—The rhizome and roots, official 1880–1900; N. America (Canada to S. Carolina). Perennial climber, 2.5–3.5 M. (8–12°) long; stem

**MENISPERMACEÆ.**

round, **striate**; leaves 10–12.5 Cm. (4–5') broad, peltate, 3–5-lobed, pale **beneath**, petioles long; flowers small, yellowish; fruit 8 Mm. ( $\frac{1}{3}$ ') thick, **black**, resembling grapes. Rhizome 1 M. ( $3^{\circ}$ ) long, 6 Mm. ( $\frac{1}{4}$ ') thick, **yellowish-brown**, knotty, wrinkled lengthwise, roots many, frac-

FIG. 132.



*Menispermum canadense*: transverse section of rhizome magnified.

ture tough, woody, inside yellowish, bark thick, wood-rays broad, porous, and longest on lower side, pith distinct; nearly inodorous; taste bitter; contains berberine (yellow), menispine, starch, gum, resin, tannin.

Tonic, alterative, diuretic; similar to calumba (owing to its bitterness); scrofulous affections, as a substitute for sarsaparilla. Dose, gr. 15–60 (1–4 Gm.); fluidextract (alcohol 65 p. c.), 3ss–j (2–4 Cc.).

CALUMBA. CALUMBA.

**Jateorhiza palmata**, (*Lamarck*) *Miers*. } The dried root.  
(**Jateorhiza calumba**, (*Roxburgh*) *Miers*.) }

*Habitat.* E. Africa, Madagascar (Mozambique and Quilimani forests, along the lower Zambesi River); cultivated in Africa and E. India islands.

*Syn.* Columbo, Kalumb, Foreign Colombo, Columba; Br. Calumbæ Radix; Fr. Columbe, Racine de Colombo (Calumbé); Ger. Radix Colombo, Colombowurzel.

**Jat-e-o-rhi'za.** L. fr. Gr. *iathp(ros)*, healing, + *ρίζα*, a root—i. e., its medicinal virtues.

**Pal-ma'ta.** L. *palmatus*, like the palm of the open hand—i. e., the leaves palmately-lobed or divided.

**Ca-lum'ba.** L. fr. native African name, *kalumb*, hence Colombo in Ceylon, supposed to be the plant's original habitat.

PLANT.—Resembles very closely *Menispermum canadense*, hairy, perennial climber, although hispidity varies, reaching the tops of lofty trees; leaves large, 25 Cm. (10') long, 35 Cm. (14') wide, orbicular, cordate, 3–5–7-palmately-lobed, lobes entire, wavy, hairy; flowers

FIG. 133.

*Jatropha palmata (calumba).*

diœcious, 6's, 12 Mm. ( $\frac{1}{2}$ ') wide; stem grows from short, thick, irregular rhizome. Roots, arise from the rhizome, numerous, fleshy, fasciculated, fusiform, 2.5–10 Cm. (1–4') thick; these are dug in dry season (March), collected, washed, cut in transverse slices, and dried slowly in the shade. Occurs commercially in circular or oval, biconcave sections (disks), 2.5–5 Cm. (1–2') wide, 2–12 Mm. ( $\frac{1}{4}$ – $\frac{1}{2}$ ') thick, greenish-brown, roughly wrinkled, centre depressed (thinnest), internally yellowish or grayish-yellow, with few interrupted circles of fibrovascular bundles, distinctly radiate in the outer portion, with a dark cambium, which separates the bark from the wood, fracture short, mealy; parenchyma contains starch; odor slight; taste slightly aromatic, bitter, mucilaginous; often more or less worm-eaten. Enters market from Zanzibar or via Bombay; is controlled by Portuguese, as it was when they held possession of Ceylon. Solvents: alcohol (75 p. c.); boiling water extracts most of the virtues (calumbin and berberine). Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Roots of *Bryonia alba* and *Frasera carolinensis* (Walteri)—American Columbo. These sometimes are dyed yellow with turmeric or safflower, and made bitter with infusion of calumba or quassia, thus giving a near resemblance, but recognized by their lighter or slightly false color, absence of dark cambium zone, radiating lines, etc.; the latter also precipitates with iron salts, is not mucilaginous



**MENISPERMACEÆ.**

nor affected by infusion of galls, reddens litmus, evolves ammonia with fixed alkalies, and contains no starch. Occasionally with slices of the stem of *Coscin'ium fenestra'tum*, Ceylon; these are harder, smoother, and not centrally contracted.

**CONSTITUENTS.**—Calumbin 0.8 p. c., Berberine 1 p. c., Calumbic acid, calumbine (?), starch 35 p. c., pectin 17 p. c., gum 4.7 p. c., resin 5 p. c., wax, ash 6 p. c.

**Calumbin**,  $C_{21}H_{24}O_7$ .—Obtained by exhausting root or alcoholic extract with alcohol or ether, evaporating and letting stand several days for crystals to form, which are white, bitter, odorless, soluble in alcohol, ether, chloroform, alkalies, acetic acid, almost insoluble in water. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

**Berberine**,  $C_{20}H_{17}NO_4$ .—This is left in mother-liquor from calumbin, which is evaporated to dryness, exhausted with boiling alcohol, evaporated, allowed to crystallize upon standing. These two, constituting the drug's activity, may be purified, and berberine converted into yellow, bitter crystalline salt. The alkaloid is the same as first found in *Berberis vulgaris*, etc. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

**Calumbic Acid**,  $C_{21}H_{22}O_6 + H_2O$ .—Obtained from 3 p. c. oxalic acid infusion by adding barium hydroxide and treating precipitate with alcohol; it is less bitter than calumbin, amorphous, straw-yellow, soluble in alcohol, alkalies, almost insoluble in water or ether, and is in combination with berberine—the two believed to be derived from calumbin, this latter being the anhydride of calumbic acid.

Calumba contains no tannin, hence can well be used with iron salts and alkalies as a substitute for gentian, etc.; its infusion or tincture, however, precipitates with infusion of galls or solution of lead acetate.

**PREPARATIONS.**—1. *Fluidextractum Calumbæ*. Fluidextract of Calumba. (Syn., Extractum Calumbæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Colombo; Ger. Flüssiges Kolomboextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 70 p. c., 1 s., evaporate to 100 Cc. Dose, m v–30 (.3–2 Gm.).

2. *Tinctura Calumbæ*. Tincture of Calumba. (Syn., Tinctura Colombo; Fr. Teinture de Colombo; Ger. Kolombotinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol 60 p. c., q. s. 100 Cc. Dose, 3ss–2 (2–8 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 1–5 (.06–.3 Gm.). *Infusion*, 5 p. c., dose, 3ss–1 (15–30 Cc.).

**PROPERTIES.**—Tonic, stomachic, stimulant, increases appetite and digestion by stimulating the gustatory nerves, thereby dilating the gastric vessels and augmenting secretion, does not constipate; externally—antiseptic, disinfectant, anthelmintic.

FIG. 134.



Calumba: transverse section, natural size: r, bark; k, cambium; h, wood; m, pith (medulla).



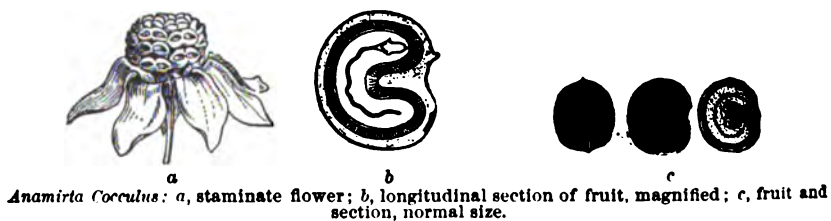
Uses.—Dyspepsia, debility, remittent fevers, dysentery, diarrhoea, cholera morbus, cholera infantum, hectic fever of phthisis, vomiting of pregnancy, bowel flatus, purging ; large doses emeto-cathartic.

FIG. 135.



*Anamirta Cocculus (paniculata).*

FIG. 136.



*Anamirta Cocculus*: a, staminate flower; b, longitudinal section of fruit, magnified; c, fruit and section, normal size.

*Allied Plants :*

1. *Jateorhiza calumba*.—About the same as the official, possibly having a variety difference in that the basal lobes of leaves are

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rounded but do not overlap, and male inflorescence is hispid. In the official variety, once also called *Cocculus palma'tus*, basal lobes mostly overlap, and male inflorescence is smooth. Our commercial root is collected indiscriminately from both species.

2. *Anamir'ta Cocculus (panicula'ta), Cocculus Indicus*.—E. India, Ceylon. Large woody climber; leaves 10–20 Cm. (4–8') long, cordate; flowers, small dioecious; fruit (in clusters 2–5) reniform, drupe, 8 Mm. ( $\frac{1}{3}$ ') long, blackish-brown, wrinkled; seed reniform; contains (seed)—picrotoxin, anamirtin (cocculin, not bitter or poisonous), fat; (pericarp, nearly tasteless)—menispermene, paramenispermene, hypopicrotoxic acid, resin. *Picrotoxin* (picrotoxinum),  $C_{30}H_{54}O_{13}$ —official 1880–1900, not a single body, but composed of picrotoxin 54 p. c., and picrotin 46 p. c.; obtained by evaporating to syrup a tincture made with hot alcohol, removing fat, boiling residue with water, filtering, which deposits picrotoxin upon cooling. It is in colorless, shining prismatic crystals or powder, odorless, very bitter, soluble in alcohol, ether, chloroform; with  $H_2SO_4 + NaNO_3 + NaOH$  gives brick-red, fading in few hours. Cerebro-spinal excitant, nervine, antiparasitic, with combined action of belladonna and nux vomica; slows heart and respiration, causes spasms of flexors, death by paralyzing heart; convulsions resemble epileptic paroxysms (circular spasms)—those of strychnine being tonic (tetanic), affecting the extensors; paralysis (laryngeal), epilepsy, chorea, eclampsia, chronic spasms of the limbs, vomiting with giddiness, morphine antidote; externally—parasitic skin diseases, itch, lice, ringworm (avoiding abraded surfaces); powdered berries, mixed with dough, sometimes thrown upon water in order to catch fish; after eating this, fish whirl around, become stupefied, and lie motionless upon the surface, so that they may readily be picked up; berries also prevent secondary fermentation of alcoholic liquors, adding strength thereto, but dangerous. *Poisoning*—symptoms and treatment similar to strychnine. Dose, seeds, gr. 1–3 (.06–.2 Gm.); tincture 25 p. c. (diluted alcohol), Mij–15 (.13–1 Cc.); picrotoxin, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.001–.002 Gm.); menispermene, gr. 1–2 (.06–.13 Gm.); decoction, 2.5 p. c.; ointment, 2 p. c.

**30. LAURACEÆ. Laurel Family.**

**La-ra'se-e.** L. *Laur-us* + aceæ, bay tree, fr. Celtic *blaur* (= *lawr*, the *b* dropped), signifying green—*i. e.*, referring to plant's foliage. Trees or shrubs. Distinguished by being aromatic (volatile oils); leaves simple, pellucid-dotted; flowers polygamous, calyx 4–6, in 2 rows, petaloid, regular; stamens perigynous, distinct, anthers opening by 2–4 uplifted valves; ovary 1-celled; ovules 1 in each cell; fruit drupe or berry; tropics, temperate climates; aromatic, stimulant (vol. oil), narcotic, sudorific, tonic, stomachic, febrifuge, astringent; timber, some fruits edible.

Genera : 1. *Sassafras*. 2. *Cinnamomum*.

## SASSAFRAS. SASSAFRAS.

1. SASSAFRAS. *Sassafras*.2. SASSAFRAS MEDULLA. *Sassafras* Pith.

*Sassafras variifolium*, Salisbury.  
(*Sassafras* (*Sassafras*, Linné) Karsten.)

1. The dried bark of the root, collected in early spring or autumn, and deprived of periderm. 2. The dried pith.

*Habitat.* N. America (Canada, Florida to Texas), in woods with rich soil.

*Syn.* *Saxifrax*, Saloop, Ague Tree, Cinnamon Wood: Br. *Sassafras* (Cortex) *Radix*; Fr. *Ecorce de Sassafras*; Ger. *Lignum Sassafras*, *Sassafrasholz*, *Sassafrasrinde*.

*Sas'sa-fras.* L. *saxum*, rock, + *frangere*, to break—i. e., grows in crevices of rocks; Sp. for *saxifrage*, name given by Monardes, Spanish botanist of sixteenth century.

*Va-ri-i-fo-li-um.* L. *varius*, varying, + *folium*, leaf—i. e., leaves of several forms on the same tree, ovate, entire, 3-lobed and cuneate at base.

**PLANT.**—Occurs as a shrub in the North, but a tree in the South, 9–24 M. (30–80°) high, .3–.6 M. (1–2°) thick; wood whitish or reddish, light, strong, durable, aromatic; bark of stem and large branches rough, deeply furrowed, grayish, young end-twigs smooth, green; leaves 10–15 Cm. (4–6') long, varying shape; flowers March–May, fragrant, appearing before the leaves, small, greenish-yellow, dioecious, racemes; fruit, oval drupe, size of pea, deep blue, 1-seeded. **BARK**

FIG. 137.



*Sassafras variifolium*: 1, fruiting twig; 2, flowering twig.

**OF ROOT** (*sassafras*), in irregular transversely curved, reddish-brown pieces, deprived of gray corky layer, of variable length, 0.5–5 Mm. ( $\frac{1}{30}$ – $\frac{1}{8}$ ') thick, outer surface nearly smooth, inner obscurely short-striate, soft, fragile, with short, corky fracture; strongly fragrant; taste mucilaginous, aromatic, astringent. *Solvents*: alcohol; hot water. Dose, 3ss–1 (2–4 Gm.). **PITH OF BRANCHES** (*sassafras* pith or medulla), in more or less cylindrical, often curved or coiled pieces, 2.5–5 Cm. (1–2') long, 5 Mm. ( $\frac{1}{5}$ ') thick, whitish, very light, spongy; odor slight; taste mucilaginous; should be collected

in autumn after frost. *Solvents*: macerated in water yields a mucilage not precipitated by alcohol. Dose, ʒj–4 (4–15 Gm.).

**Commercial.**—The stem-bark is in elongated strips or fragments, lighter gray, longer and deeper fissured on outer surface, less aromatic, more mucilaginous and bitter; powder of root-bark has very thin-walled parenchymatic cells, without pores, but filled with starch grains,

**LAURACEÆ.**

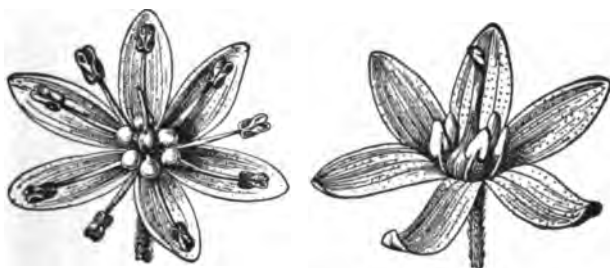
thereby differing from those of the stem-bark ; in the former, bast fibres are very rare and always detached, starch grains in groups.

**CONSTITUENTS.**—I. **BARK :** Volatile oil 6–9 p. c., Sassafrid 9 p. c., tannin 6 p. c., starch, gum, resin, wax. II. **PITH :** Mucilage.

**Oleum Sassafras.** Oil of Sassafras, *official.*—(Syn., Fr. Essence de Sassafras ; Ger. Sassafrasöl.) This volatile oil is obtained by distilling the root, especially root-bark, with water or steam ; while the bark, owing to its larger yield, is preferred, yet in practice the whole root frequently is chipped up and distilled, yielding about  $\frac{1}{5}$  p. c. of unrec-tified oil. Maryland is the centre of production. It is a yellowish liquid when from root-bark or recently felled trees, reddish from roots of old stumps ; characteristic odor of sassafras, warm, aromatic taste, darker and thicker by age, sp. gr. 1.070, soluble in 90 p. c. alcohol, dextrogyrate ; contains chiefly safrol,  $C_{10}H_{10}O_2$ , 80 p. c., pinene and phellandrene,  $C_{10}H_{16}$ , 10 p. c., *d*-camphor 6.8 p. c., eugenol,  $C_{10}H_{12}O_2$ , 0.5 p. c., cadinene, residue 3 p. c. Should be kept dark, cool, in amber-colored, well-stoppered bottles. Dose, Mj–5 (.06–.3 Cc.).

**ADULTERATIONS.**—Camphor oil, distilled in fractions having same specific gravity ; often sold as artificial sassafras oil, difficult to distinguish.

FIG. 138.



*Sassafras variifolium* : a, staminate flower ; b, pistillate flower.

**Safrolum.** Safrol,  $C_{10}H_{10}O_2 = C_6H_5 \cdot C_3H_8(OOCH_2)$ , *official.*—(Syn., Fr. Safrol ; Ger. Safrol.) This chemically is the methylene ether of allyl pyrocatechol, occurring in the oils of camphor, star-anise, cinnamon, etc., and constituting 80 p. c. of the oil of sassafras. It is obtained chiefly from the red oil of camphor by collecting that fraction boiling at  $230^\circ C.$  ( $446^\circ F.$ ), purifying the same by repeated chilling and crystallization ; it is a colorless or faintly yellow liquid, sassafras-like odor, sp. gr. 1.105, optically inactive, cooled to  $-20^\circ C.$  ( $-4^\circ F.$ ) solidifies to a mass of crystals, melting at  $11^\circ C.$  ( $52^\circ F.$ ), soluble in 1 part alcohol, 30 of 70 p. c. alcohol, miscible with ether, chloroform, boils at  $233^\circ C.$  ( $451^\circ F.$ ) ; heated with alcoholic potassium hydroxide solution forms isosafrol, which is less toxic than safrol, with bromine yields crystals of  $C_{10}H_8Br_2O_2$ . Reduces arterial pressure by depressing vasomotor centre ; taken a long period produces fatty degeneration of heart, liver, and kidneys ; it is eliminated as piperonic acid. Dose, Mj–2 (.06–.13 Cc.).

**Sassafrid.**—Supposed to be altered tannin, the result of oxidation, analogous to cinchonic-red, some disclaim its presence in fresh bark, crystallizes in yellowish-brown granules, soluble in alcohol, insoluble in ether, solutions colored red by alkalies, precipitated by alkaline earths (carmine-red), ferric salts (greenish-brown), lead acetate (white), inodorous, nearly tasteless.

**PREPARATIONS.**—I. BARK: 1. *Fluidextractum Sarsaparillæ Compositum*, 10 p. c.

*Unoff. Preps.*: *Fluidextract*, dose, ʒss–1 (2–4 Cc.). *Infusion or Tea*, dose, *ad libitum*.

II. OIL: 1. *Syrupus Sarsaparillæ Compositus*,  $\frac{1}{50}$  p. c. 2. *Trochisci Cubeæ*,  $\frac{1}{8}$  M (.01 Cc.).

III. PITH: 1. *Mucilago Sassafras Medullæ*. Mucilage of Sassafras Pith. (Syn., Fr. Mucilage de Moëlle de Sassafras; Ger. Sassafrasmarkschleim.)

*Manufacture*: 2 p. c. Macerate 3 hours 2 Gm. in water q. s. 100 Cc., strain without expression. Should be freshly made when wanted. Dose, *ad libitum*. Mostly used externally.

**PROPERTIES.**—I. BARK: Alterative, diaphoretic, stimulant, emmenagogue.

II. PITH: Demulcent, emollient.

**USES.**—I. BARK: To purify blood, skin diseases, rheumatism, syphilis. Infusion valuable antidote for poison-oak, given internally and applied locally; it (tea) once was popular for so-called thinning the blood in spring; given with sarsaparilla, guaiacum, etc.

II. OIL: Anodyne, stimulant in neuralgia, to dispel insects; said to neutralize emetic and narcotic effects of tobacco and hyoscyamus, popular as a flavoring agent in confectionery, drinks, soaps, etc.

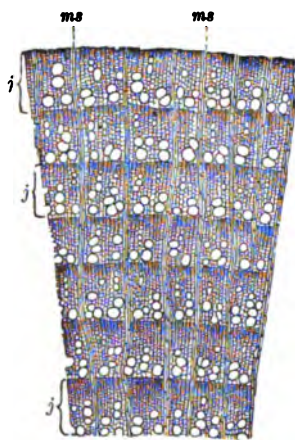
III. PITH: Mostly in collyria—conjunctivitis, acute gastritis, dysentery, febrile affections, throat trouble, in poisoning by corrosives; used to suspend insoluble substances and for flavoring.

*Allied Plants*:

1. *Umbellula'ria californica*, *California Bay Laurel* or *Spice Tree*.—Wood brownish, close-grained, esteemed for cabinet-work; leaves yield volatile oil 4 p. c., with nutmeg and cardamom odor; seeds contain a fat; stimulant, anodyne in diarrhœa, neuralgia, headache.

2. *Sassafras Lignum*, *Sassafras Wood*.—Contains little volatile oil; used like the bark, but very weak medicinally.

FIG. 139.



Sassafras wood: cross-section, magnified 20 diam.; j, annual rings; ms, medullary rays.

## LAURACEÆ.

## CINNAMOMUM. CINNAMON.

## 1. CINNAMOMUM SAIGONICUM. Saigon Cinnamon.

*Cinnamomum*, } The bark of an undetermined species.  
species unnamed.

## 2. CINNAMOMUM ZEYLANICUM. Ceylon Cinnamon.

*Cinnamomum* }  
*zeylanicum*, Nees. } The inner bark of the shoots.

*Habitat.* 1. Annam (Cochin China). 2. Ceylon; cultivated in China, Java, Sumatra, South America, W. Indies.

*Syn.* 1. Annam—China—God's Cinnamon, Annam Cassia, Cortex Cinnamomi Saigonici; Fr. Cannelle de Saigon; Ger. Saigonzimmt. 2. Cinnamomum (U. S. P. 1880); Br. Cinnamomi Cortex, True Ceylon Cinnamon, True or Suet Cinnamon, Cinnamomum (acutum) verum; Fr. Cannelle de Ceylon; Ger. Zeylonzimmt, Brauner Canel.

*Cin-na-mo'mum.* L. fr. Ar. *kinnamon*, cinnamon, probably connected with *qaneh*, a reed, cane—i. e., resemblance of stems; or Malay *kaju manis*, sweet wood, from its aromatic odor and taste.

*Sa-i-gon'i-cum.* L. belonging to Saigon, a country and city in Southern Annam—i. e., its native habitat.

*Ze-y-lan'i-cum.* L. belonging to Ceylon—i. e., its habitat.

**PLANTS.**—Handsome evergreen trees 6–9 M. (20–30°) high, trunk .3–.5 M. (12–18') thick, young twigs slightly quadrangular; leaves coriaceous, 3–5-nerved, but only midrib reaching apex, bright glossy-green above, glaucous beneath, 10–20 Cm. (4–8') long; flowers Jan.–March, small, hermaphrodite or polygamous, producing fleshy, black, ovoid fruit, which adheres like the acorn to the cup-shaped perianth, size of small olive. **BARK:** 1. *Saigon, Annam Cassia (Cinnamon).* In unscrapped quills, 15 Cm. (6') long, 10–15 Mm. ( $\frac{2}{5}$ – $\frac{3}{5}$ ') broad, bark 2–3 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ') thick, light grayish-brown, with whitish patches, rough from numerous warts, transverse ridges and fine longitudinal wrinkles, inner surface cinnamon-brown or dark brown, granular, slightly striate, fracture short, granular, many whitish striæ near the cork forming an almost uninterrupted line; odor agreeable, aromatic; taste warmly aromatic, astringent. 2. *Ceylon Cinnamon.* In long, closely rolled quills, of 8 or more layers of bark (liber) the thickness of paper, pale yellowish-brown, outer surface smooth, marked with wavy lines of bast-bundles, inner surface striate, fracture short-splintery; odor agreeably aromatic; taste sweet, warmly aromatic; when distilled yields 0.5–1 p. c. volatile oil (less than preceding—0.5–1.5 p. c.), the most delicate of all and only approximated by the finer grades of the other kinds. **Solvents:** alcohol; hot water partially. **Dose,** gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—1. Cassia bark, and a closely resembling bark

FIG. 140.

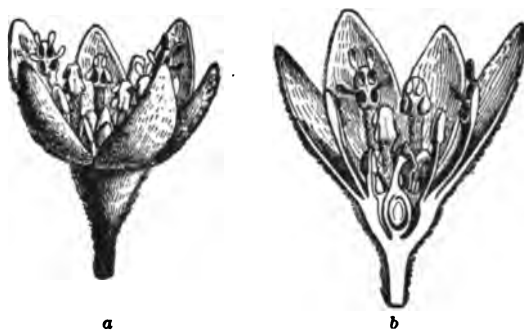


Cinnamomum twig, showing leaf venation.

of unknown derivation, having lighter gray color and coarser structure, identified by weak odor and taste, possibly unscrapped Guava bark quills, and clove bark. 2. Scarcely possible in the entire state. Powder of either variety not found on the market, all so labeled being cassia, which is subject to endless adulteration—chips, siftings, buds, walnut-shells, beans, grains, starch, clove-buds, etc.

*Commercial.*—Cinnamon was a very early favorite spice, being brought by Arabian navigators to the Phœnicians, Grecians, and Romans, the Chinese cassia being used first, the Ceylon not until 1275. While there are about 50 species growing wild, only a few yield the commercial bark—this resulting mostly from cultivated plants. At one time Ceylon excelled in the industry, but there coffee has largely replaced it, thus restricting to the neighborhood of Colombo its principal cinnamon gardens. However, S. China has become equally interested in the cultivation and as a result produces much valuable

FIG. 141.



Cinnamomum: a, flower; b, vertical section of the same.

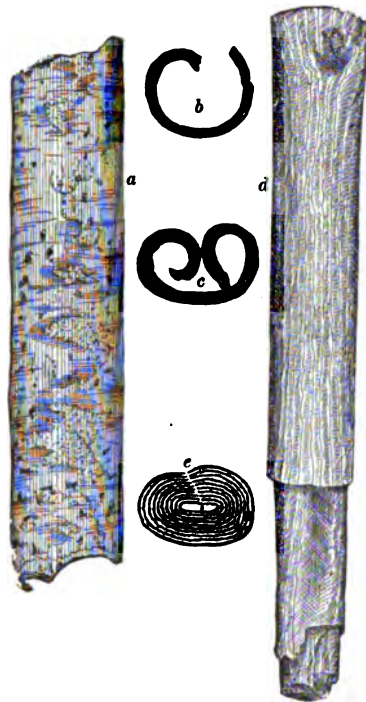
bark. 1. *Saigon*. This is thought to be entirely from wild trees (*C. Lourei'rii*, after Loureiro, celebrated botanist, and other species), growing in the mountainous districts of Annam. While sometimes chips and thick trunk-bark reach us, most of it is from branches and small stems; all of it is of good quality, being sweet, aromatic, nearly void of astringency and bitterness. Some consider it high-grade cassia, but its distinct structure, specific growth area, and absence of objectionable qualities in the corky layer, seem to preclude such a possibility; it is certainly more closely related to cassia than Ceylon, and may be an inferior grade of that distinctive Chinese cinnamon so highly prized by natives from one or more species distinct from *C. Cassia*. 2. *Ceylon*. This is the best known cinnamon, being nearly all the product of cultivated plants, which are allowed never to become trees, but are pollarded so as in 2–3 years to produce many slender stems with bark devoid of astringent corky layer, this not having yet had time to form. The cultivation of cinnamon begins with the planting of seeds in prepared soil, 4–5 in each hill; in 5–6 years the straight stems from continued pruning, 1.5–3 M. (5–10°) high, are cut down with catty-



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knives, and by coppicing a new crop of twigs is formed every 2–3 years. The barking (March–June, after which delicacy and aroma lessen) takes place under cover by making 2 equidistant longitudinal incisions and transverse ones every few feet apart, then teasing off easily with a mama-knife (Saigon); the bark is now allowed to wilt or undergo partial fermentation for several days, becoming soft and pliable, thus facilitating epidermal separation, when it is laid concave downward and scraped to the layer of stone-cells, thereby rejecting the bitter or astringent portion (Ceylon); congeries of quills are formed,

FIG. 142.



Cinnamonum : a, b, c, from China; d, e, from Ceylon.

which when dried (first by shade, then by sun) are made into 30-pound (14 Kg.) bundles and marketed as to quality in *firsts*, *seconds*, *thirds*, the inferior grades being distilled for oil, or each quill is dried separately (Saigon) and tied into bundles for exportation. The bark is imported loose or in bundles with split bamboo bands from Canton, Hong Kong (Saigon), Calcutta, Colombo.

**CONSTITUENTS.**—Volatile oil 0.5–2 p. c., tannin 3–5 p. c., resin, bitter principle, sugar, mannite, starch, mucilage, ash 2–5 p. c.

**Oleum Cinnamomi.** Oil of Cinnamon, Oil of Cassia, *official.*—(Syn., Oleum Cinnamomi Cassiæ, Oil of Chinese Cinnamon; Fr.



Essence (Huile) de Cannelle de Chine; Zimmtöl, Zimmtkassienöl.) This volatile oil should contain at least 75 p. c. of cinnamic aldehyde; it is obtained by distilling the leaves and waste bark of *Cassia cinnamom*, and is a brownish liquid that darkens and thickens by age; characteristic cinnamon odor, sweetish, spicy, burning taste, sp. gr. 1.055, soluble in 2 volumes 70 p. c. alcohol, optically almost inactive, shaken with saturated solution sodium bisulphite solidifies to crystalline mass; contains 70–80 p. c. cinnamic aldehyde,  $C_9H_7CHO$  (oxidizing into resin and cinnamic acid), upon which the value depends, also cinnamyl acetate,  $C_9H_9C_2H_3O_2$  (liquid of unpleasant acrid taste), and phenylpropyl acetate, orthocumaric aldehyde, cinnamic acid,  $C_9H_7O_2$ ; this latter is not in fresh oil, and after being formed, by further oxidation becomes benzoic acid. *Tests*: 1. Oil 1 Cc. + 3 Cc. 75 p. c. alcohol, gives clear solution; add 2 Cc. saturated solution lead acetate in 75 p. c. alcohol get no precipitate (abs. of petroleum, rosin). 2. Shaken with hydrogen sulphide T. S. should not assume dark color (abs. of lead, copper). *Assay*: Cinnamic aldehyde—To oil 10 Cc. in a cassia-flask add 30 p. c. sodium bisulphite solution 10 Cc., shake, heat on water-bath, until liquefied, add several 10 Cc. portions of bisulphite solution until flask three-fourths filled, shaking and heating after each, heat until cinnamic aldehyde odor no longer perceptible, cool, add bisulphite solution to raise lower limit of oily layer to the zero mark of scale; residual liquid should not measure more than 2.5 Cc., corresponding to at least 75 p. c., by volume, of cinnamic aldehyde. Should be kept cool, dark, in well-stoppered, amber-colored bottles. The Ger. P. and U. S. P. recognize only oil of Chinese cinnamon, while the Br. P. and Fr. Codex that of Ceylon cinnamon; the former is more abundant, cheaper, the latter finer flavor, more delicate aroma, containing besides cinnamic aldehyde, some eugenol and phellandrene. Dose,  $\text{m}j\text{--}\bar{v}$  (.06–.3 Cc.).

ADULTERATIONS.—Oil distilled from flowers and roots, phenol (carbolic acid), oil of cloves, petroleum, colophony.

PREPARATIONS.—I. SAIGON BARK: 1. *Tinctura Cinnamomi*. Tincture of Cinnamon. (Syn., Fr. Teinture de Cannelle; Ger. Zimmttinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with glycerin 7.5 Cc., alcohol 67.5, water 25, finishing with alcohol 73 p. c., q. s. 100 Cc. Dose,  $\text{zss--2}$  (2–8 Cc.).

2. *Pulvis Aromaticus*. Aromatic Powder. (Syn., Br. Pulvis Cinnamomi Compositus, Compound Powder of Cinnamon; Fr. Poudre aromatique, Poudres des (Épices) Aromates; Ger. Aromatisches Pulver, Gewürzpulver.)

*Manufacture*: 35 p. c. Saigon cinnamon 35 Gm., ginger 35; cardamom 15, nutmeg 15. Dose, gr. 10–30 (.6–2 Gm.).

Preps.: 1. *Fluidextractum Aromaticum*. Aromatic Fluidextract. (Syn., Extractum Aromaticum Fluidum, U. S. P. 1890; Fr. Extrait liquide aromatique des Aromates; Ger. Flüssiges (Gewürz) Aromatischesextrakt.)

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*Manufacture*: Macerate, percolate aromatic powder 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\nu$ -30 (.6-2 Cc.).

2. *Pilule Aloes et Ferri*, 1 gr. (.06 Gm.). 3. *Pilule Aloes et Myrrha*,  $\frac{3}{4}$  gr. (.04 Gm.).

3. *Tinctura Cardamomi Composita*, 2.5 p. c. 4. *Tinctura Gambir Composita*, 2.5 p. c. 5. *Tinctura Lavandule Composita*, 2 p. c. 6. *Tinctura Rhei Aromatica*, 4 p. c. 7. *Vinum Opii*, 1 p. c.

II. OIL: 1. *Aqua Cinnamomi*. Cinnamon Water. (Syn., Fr. Eau de Cannelle; Ger. (Einfaches) Zimmtwasser.)

*Manufacture*:  $\frac{1}{2}$  p. c. Triturate oil .2 Cc. with purified talc 1.5 Gm., water q. s. 100 Cc., filter until clear. Dose,  $\mathfrak{Z}\text{ss}$ -1 (15-30 Cc.).

*Preps.*: 1. *Infusum Digitalis*, 1.5 p. c. 2. *Mistura Creta*, 40 p. c.

2. *Spiritus Cinnamomi*. Spirit of Cinnamon. (Syn., Fr. Alcoolat de Cannelle; Ger. Zimmtspiritus.)

*Manufacture*: 10 p. c. Dissolve oil 10 Cc. in alcohol q. s. 100 Cc. Dose,  $\mathfrak{M}\nu$ -30 (.3-2 Cc.).

*Prep.*: 1. *Syrupus Rhei*,  $\frac{2}{3}$  p. c.

3. *Acidum Sulphuricum Aromaticum*,  $\frac{1}{10}$  p. c.

*Unoff. Preps.*: BARK: *Fluidextract*, dose,  $\mathfrak{M}\nu$ -30 (.3-2 Cc.). *Syrup* (bark 10, water 50, sugar 60), for flavoring. *Infusion*, dose,  $\mathfrak{ss}$ -2 (30-60 Cc.).

PROPERTIES.—Carminative, stomachic, stimulant, astringent, hæmodynamic, aromatic, antispasmodic, germicide. The oil has no astringency.

USES.—Diarrhœa, flatulence, nausea, vomiting, menorrhagia, parturient, to correct griping medicines, for flavoring preparations, chocolate, etc.

*Allied Products*:

1. **Cinnaldehydeum**. Cinnamic Aldehyde,  $\text{C}_9\text{H}_8\text{O}$ , *official*.—(Syn., Phenylacrolein; Fr. Aldehyde cinnamique; Ger. Zimmt (saure) aldehyd.)

*Manufacture*: This aldehyde is obtained as a natural product by shaking oil of cassia with aqueous solution of acid sodium sulphite, filtering, washing crystalline magma with alcohol, decomposing with diluted sulphuric acid, or synthetically by oxidation of cinnamyl alcohol by dry distillation of a mixture of calcium cinnamate and formate, or by action on a mixture of benzaldehyde and acetaldehyde with hydrochloric acid gas (or solution sodium hydroxide). It is a colorless liquid, cinnamon-like odor, burning, aromatic taste, sp. gr. 1.047, boils at 250° C. (482° F.) with partial decomposition, optically inactive, solidified with ice and salt should melt at -7.5° C (18.5° F.), soluble in alcohol, ether, fixed and volatile oils, sparingly in water; contains at least 95 p. c., pure cinnamic aldehyde. *Assay*: Weigh 12 drops, add 5 Cc. distilled water - few drops phenolphthalein T. S., neutralize with  $\frac{\text{N}}{10}$  sodium hydroxide V. S., add 50 Cc. of solution sodium sulphite (1 in 5), place in boiling water, add  $\frac{\text{N}}{2}$  hydrochloric acid V. S. to maintain neutrality, agitate frequently, adding 1-2 drops phenolphthalein T. S., when neutral note number Cc. of  $\frac{\text{N}}{2}$  V. S. consumed, make blank test and note Cc.  $\frac{\text{N}}{2}$  V. S. required, subtract this from number in original

test, each Cc. of difference corresponds to 0.033 Gm. cinnamic aldehyde; to find p. c.—multiply above difference by 0.033, this product by 100, divide by original weight taken. *Impurities*: Chlorinated products, etc. Should be kept in well-stoppered, small, amber-colored bottles. Dose, Mj-5 (.06-.3 Cc.).

**PROPERTIES AND USES.**—Similar to oil of cinnamon, for which it may be substituted.

2. *Cinnamomum Cassia* (*aromat'icum*), *Chinese Cinnamon*.—The dried bark of the shoots deprived of most of the corky portion. official 1820-1900; China. Plant—handsome tree, but bark removed when 5-6 years old, occurring in quills 5-20 Mm. ( $\frac{1}{2}$ - $\frac{4}{5}$ ') broad, bark 1-2 Mm. ( $\frac{1}{25}$ - $\frac{1}{12}$ ') thick, deprived of corky layer, yellowish-brown, often with grayish patches, rough, inside nearly smooth, faintly striate, fracture nearly smooth; odor fragrant; taste sweet, aromatic, pungent, astringent. The outer layers are simply imperfectly removed by curved knives or planes, those of iron being avoided, consequently can be recognized readily by having undergone this treatment, also by its more irregular zone of stone-cells, the greater abundance of bast fibres and tannin. This bark is very irregular in quality, owing to its varied origin, and accordingly is recognized in commerce as Cassia, Cassia vera, Cassia lignea, etc. *C. Burman'ni* is believed to yield the Sumatra, also a portion of the Java, China, Timor; *C. Tam'ala*, some of the Calcutta, N. India, Cochin China; *C. i'ners*, part of E. Indian archipelago.

3. *Cassia Buds*, *Flores Cassiæ*.—These are the small, stem-like, immature fruits of various species, somewhat resembling, but smaller than cloves, having fine cinnamon odor and taste; contain oil of cinnamon, tannin, etc.

## CAMPHORA. CAMPHOR.

*Cinnamomum Camphora*, } The dextrogyrate ketone (concrete vol-  
(*Linné*) *Nees et Ebermaier*. } atile oil), purified by sublimation.

*Habitat*. China, Japan, Formosa. Tree cultivated in Italy as an ornament, and may yield profitably in California, Florida, etc., wherever frosts are light.

*Syn*. Camphor Laurel, Gum Camphor Tree; Fr. Camphre; Ger. Kampher, Kampher, Campher.

**Cam'pho-ra**. L. fr. Ar. *kafur* or *kapur*, chalk, lime—i. e., its resemblance.

**PLANT.**—A tree 9 M. (30°) high, much branched, resembles the sassafras and linden, growing up to 600 M. (2,000°) elevation in tropics—Cape Good Hope, Brazil, Jamaica, Madeira, Mediterranean region, etc.; bark smooth, green; leaves evergreen, 7.5-15 Cm. (3-6') long, 2.5-7.5 Cm. (1-3') wide, attenuated toward both ends, entire, glaucous beneath, thick; flowers June-July, small, whitish; fruit, Nov.-Dec., purple berry, 6 Mm. ( $\frac{1}{4}$ ') thick, 1-seeded. **DEXTROGYRATE KETONE** (camphor), in white, translucent masses, tough, crystal-

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line, easily powdered with a little alcohol, chloroform, or ether; odor penetrating, characteristic; taste pungent, aromatic; sp. gr. 0.995; soluble in alcohol, ether, chloroform, carbon disulphide, petroleum benzin, fixed and volatile oils, slightly in water; liquefied with equal quantities of menthol, thymol, phenol, or hydrated chloral, volatile, inflammable, melts at 175° C. (347° F.), boils at 204° C. (399° F.),

FIG. 143.

*Cinnamomum Camphora.*

no residue. Should be kept cool, in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.).

*Commercial.*—While all parts of the tree contain and have a strong odor of camphor, it is obtained only from the root, trunk, and branches by sublimation.

1. *In Japan* roots and small branches are chipped and put with a small quantity of water into large iron vessels surmounted with earthen domes lined with rice-straw. Upon applying moderate heat, camphor, volatilized by steam, rises to the domes and condenses on the straw (flowers of camphor), from which it is shaken and packed in double-tubs, 100 pounds (45 Kg.) each. This is larger grained, lighter pink, cleaner, dryer, and higher priced than Chinese variety.

2. *In China* the comminuted plant is boiled in water until the camphor adheres to the ladle, when the strained liquid upon cool-

ing concretes; this latter, with alternating layers of earth, is now sublimed.

3. In *Formosa Island* the chips are exposed to steam, which, taking it up, deposits it in reversed pots upon condensation. A large wooden trough, coated with clay, surmounts a furnace, water is poured into the trough, a perforated board is luted to the top, upon which chips are placed, being covered with inverted earthen pots. When heat is applied steam is produced, which, rising, passes through the openings, and also chips, thus becoming camphor-vapor, which condenses on inside of pots (flowers of camphor), from which it is scraped daily and forwarded to Tamsui, Takow, etc., in baskets of 70 pounds (32 Kg.) each. In these *Formosa* ports it is stored in vats or packed in chests, tubs, (lead or tin lined) of 100 pounds (45 Kg.) each, and before shipping is saturated with water, to prevent evaporation in transit, thereby loss of weight, hence usually reaches us moist. When stored in vats a yellowish-brown volatile oil—camphor oil—drains out, which may be increased in amount by pressure.

ADULTERATIONS.—As obtained thus may have impurities 2–10 p. c.—vegetable matter, gypsum, salt, sulphur, chips, chlorinated products, etc.

Refining.—To remove such foreign material crude camphor is mixed with  $\frac{1}{10}$  part of quicklime (iron filings, sand, or charcoal), then resublimed by heating to 175–204° C. (347–400° F.), in iron, copper, or glass retorts; formerly this was done exclusively in Europe, but now largely in this country; the lime removes resin, empyreumatic oil, moisture, etc. When thus purified, it is pressed into various-shaped blocks. We have two commercial varieties: 1. *Japan, Tub, Dutch* (they being the first to introduce it), usually from Batavia. 2. *China, Formosa*; this is the cheapest, most abundant, sometimes contains ammonium chloride, usually from Canton.

CONSTITUENTS.— $C_{10}H_{16}O$ . When heated with zinc chloride yields cymol,  $C_{10}H_{14}$ ; with nitric acid yields camphoric acid,  $C_{10}H_{16}O_4$ , and camphoronic acid,  $C_9H_{12}O_5$ ; the former acid forms colorless, inodorous prisms (see page 234); the latter acid melts at 136° C. (277° F.) with decomposition and is freely soluble in water or alcohol.

PREPARATIONS.—1. *Aqua Camphoræ*. Camphor Water. (Syn., *Aqua Camphorata*; Br. *Mistura Camphoræ*; Fr. *Eau camphré*; Ger. *Kampherwasser*.)

*Manufacture*:  $\frac{4}{5}$  p. c. Dissolve .8 Gm. in alcohol .8 Cc., triturate with purified talc 1.5 Gm., when alcohol mostly evaporated triturate with distilled water, gradually added, q. s. 100 Cc., filter until clear. Dose, ʒj–8 (4–30 Cc.).

2. *Linimentum Camphoræ*. Camphor Liniment. (Syn., *Camphorated Oil*, *Linimentum Camphoratum*; Fr. (Liniment) *Huile camphré*; Ger. *Oleum Camphoratum*, *Kampheröl*, *Kampherliniment*.)

*Manufacture*: 20 p. c. Dissolve 20 Gm. in hot cottonseed oil q. s. 100 Gm.

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Prep.: 1. *Ceratum Camphoræ*. Camphor Cerate. (Syn., Fr. Unguentum (Pomatum) Camphoratum, Pommade camphré; Ger. Kamphersalbe.)

*Manufacture*: Heat together until liquefied white wax 35 Gm., white petrolatum 15, then benzoinated lard 40; while mixture is cooling add camphor liniment 10, stir until it congeals.

3. *Spiritus Camphoræ*. Spirit of Camphor. (Syn., Tinctura Camphoræ, Tincture of Camphor, Alcohol Camphoratus; Fr. (Esprit de) Alcool camphré; Ger. Spiritus camphoratus, Kampherspiritus.)

*Manufacture*: 10 p. c. Dissolve 10 Gm. in alcohol q. s. 100 Cc. Dose, ℥v-60 (.3-4 Cc.).

4. *Ceratum Plumbi Subacetatis*, 2 p. c. 5. *Linimentum Belladonnæ*, 5 p. c. 6. *Linimentum Saponis*, 4.5 p. c. 7. *Pulvis Morphine Compositus*, 32 p. c. 8. *Tinctura Opii Camphorata*,  $\frac{2}{3}$  p. c.

*Unoff. Preps.*: *Linimentum Camphoræ Ammoniatum* (Br.) 10 p. c. + strong ammonia 20 p. c. *Ointment. Vinum Camphoratum. Chloral Camphoratum* (each 50 p. c.). *Camphora Phenolata. Camphora Salicylata*, etc. Enters largely into dentifrices, camphor-ice, etc.

**PROPERTIES.**—Antispasmodic, stimulant, carminative, stomachic, (an)aphrodisiac, antipyretic, nervine, sedative, diaphoretic, rubefacient, resolvent, antiseptic. Has great healing powers; dilates vessels, increases flow of gastric juice and peristalsis.

**USES.**—Camphor was not known to Greeks or Romans, we having derived it from the Arabians, who use it solely as a refrigerant and to lessen sexual desire. Now employed in hysteria, dysmenorrhœa, nervousness, diarrhœa, colic, flatulence, rheumatism, gout, tenesmus, asthma, cough, coryza, toothache, headache, spasms, chorea, epilepsy, typhoid condition, mania. Externally as a wash, liniment, or ointment for ulcers, gangrene, scabies, sprains, bruises, rheumatic pains, convulsions.

*Poisoning*: Have burning pain, vomiting, weak pulse, giddiness, debility, pallor, cold clammy skin, faintness, confused ideas, delirium, convulsions, death from collapse; does not kill healthy adults. Give water at once if camphor taken in alcoholic solution, induce vomiting, follow with alcohol in small but frequent doses, coffee, cold, arterial sedatives, ether, artificial heat, castor oil; opium and bromides for the convulsions.

*Incompatibles*: Aconite, acids, neutral salts, water precipitates all solutions.

*Synergists*: Antispasmodics, alcohol, opium, narcotics, aromatics, all in small quantity.

*Allied Products*:

1. *Camphora Monobromata. Monobromated Camphor*,  $C_{10}H_{15}BrO$ , *official*.—(Syn., Bromo-(Brom-)camphor, Bromated (Brominated) Camphor; Fr. Camphre monobromé; Ger. Monobrom (Kamphor) Camphor.)

**Manufacture:** This substitution product of camphor is obtained by heating in a sealed tube, on water-bath, bromine and camphor in molecular proportions (preferably with a little alcohol, water, or chloroform) until reaction ceases; allow yellowish solution to crystallize, heat until mass is white, recrystallize from alcohol or benzin. It occurs in colorless prismatic needles or scales, having mild camphoraceous odor and taste, permanent; soluble in alcohol, ether, chloroform, hot benzin, fixed and volatile oils; insoluble in water, volatile without residue at  $274^{\circ}$  C. ( $525^{\circ}$  F.); soluble without decomposition in sulphuric acid, from which it separates unaltered when thrown into water. Dose, gr. 1–5 (.06–.3 Gm.), in pill or emulsion.

**PROPERTIES AND USES.**—Nervous sedative in place of camphor, over which it possesses no advantage; delirium tremens, hysteria, convulsions, coughs, insomnia, spermatorrhœa. Resembles somewhat other bromides, but must not be administered too freely as epileptiform convulsions may result. To make emulsion, add to it 6 times its weight of oil of sweet-almond and emulsify this with acacia.

2. **Acidum Camphoricum.** **Camphoric Acid**,  $C_{10}H_{16}O_4$ , *official*.—(Syn., Fr. Acide camphorique; Ger. Acidum Camphoricum, Kamphersäure.)

**Manufacture:** This dibasic organic acid is obtained by oxidizing camphor 150 Gm. with hot nitric acid 2,000 Cc. until crystallization takes place, dissolve crystals in 5 parts water containing sodium carbonate, allow solution of sodium camphorate to crystallize, dissolve crystals in 10 parts water, decompose with hydrochloric acid, when camphoric acid crystallizes out. It is in colorless, odorless, monoclinic prismatic crystals or plates, acid taste, melting at  $187^{\circ}$  C. ( $369^{\circ}$  F.), soluble in alcohol, ether, chloroform, fatty oils, 125 parts water. *Impurities:* Nitric acid, etc. Dose, gr. 5–30 (.3–2 Gm.); locally in 2–6 p. c. aqueous solutions, with 11 p. c. alcohol to each 1 p. c. acid.

**PROPERTIES AND USES.**—Antihydrotic, antiseptic, intestinal disinfectant, anticatarrhal; catarrhal affections, bronchitis, cystitis, night-sweats of phthisis, diarrhœa, gonorrhœa, sore throat, pyelitis, eczema, acne; it is rapidly absorbed and eliminated, being found in the urine from 2 to 5 hours after ingestion.

3. **Borneo, Sumatra, or Barus Camphor** (*Dryobalanops aromatica* (Camphora)),  $C_{10}H_{16}O$ , has different odor from official camphor, heavier than water, less volatile, with nitric acid yields ordinary camphor.

4. **Ngai Camphor** (*Blumea balsamifera*).—This is a tall weed of India, China, Formosa. Its camphor has same composition as Borneo, but is levogyrate, and natively is prized higher than our official.

5. **Artificial Camphor.**—Although this can be made by oxidizing camphene,  $C_{10}H_{18}$ , with chromic acid mixture, yet the more recent process is based upon the interaction of anhydrous turpentine and anhydrous oxalic acid at  $120$ – $130^{\circ}$  C. ( $248$ – $266^{\circ}$  F.), resulting in giving borneol, borneol oxalate, borneol formate, camphor, and polymerization

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products; however, the products terpin hydrate and terpene hydrochloride are generally recognized under this name—the latter being prepared by saturating oil of turpentine, dissolved in twice its volume of carbon disulphide, with hydrochloric acid gas.

6. *Oleum Camphoræ*, *Camphor Oil*, official 1870–1880.—This is a yellowish-brown volatile oil obtained from camphor by sublimation and expression; has camphor odor and taste, sp. gr. 0.940, dextrogyrate. Consists of pinene, phellandrene, cineol, dipentene, terpineol, safrol, eugenol, cadinene, and at low temperature deposits camphor. Should not be confounded with official *Linimentum Camphoræ*, which also often is called oil of camphor (Ger. *Oleum Camphoratum*).

*Allied Plants:*

1. *Nectan'dra Rodia'ei*, *Bebeeru Bark*.—The dried bark, official 1860–1880, S. America, Guiana. Large tree, 18–24 M. (60–80°) high, bark ash-gray, smooth, leaves 12.5–15 Cm. (5–6') long, 5–7.5 Cm. (2–3') wide, coriaceous, shining; flowers yellowish-white, jasmine odor, wood strong (valuable in shipbuilding); fruit, subpyriform, 5–7.5 Cm. (2–3') long, bitter. Bark flat pieces 6 Mm. (¼') thick, .3–.6 M. (1–2°) long, 10–15 Cm. (4–6') wide, many longitudinal depressions, inside cinnamon-brown, coarsely striate, fracture granular, with stone-cells, astringent, bitter; contains beberine (identical with buxine, paracine, and pelosine), siripine; wood has nectandrine. Used as tonic, antiperiodic, febrifuge for intermittents, menorrhagia, leucorrhœa, headache, neuralgia, dyspepsia, consumption, in infusion, decoction. Dose, 3ss–1 (2–4 Gm.). Beberine, gr. 1–10 (.06–.6 Gm.).

2. *Coto Bark*.—Bolivia. May be from *Dri'mys Win'teri* var. *granaten'sis*. In flat or curved pieces 12 Mm. (½') thick, cinnamon color and odor, taste pungent, bitter; contains cotoin,  $C_{14}H_{12}O_4$ , volatile oil, resin. Dose, gr. 1–5 (.06–.3 Gm.); cotoin, gr. ¾–2 (.05–.13 Gm.).

3. *Para-coto Bark*.—Bolivia. 12 Mm. (½') thick, sometimes with white fissured cork, odor nutmeg-like; contains paracotoin,  $C_{12}H_{18}O_4$ , hydrocotoin, volatile oil, resin. Used like coto bark for diarrhœa of typhoid, phthisis, sweating, cholera, nasal catarrh. Dose, gr. 5–10 (.3–.6 Gm.); tincture 10 p. c. (alcohol), 3ss–1 (2–4 Cc.); paracotoin, gr. 1–5 (.06–.3 Gm.).

4. *Ben'zoin (Lin'dera) Benzoin, Spice or Benjamin Bush*.—N. America, damp woods. Shrub 2–4.5 M. (6–15°) high, smooth; bark mostly used, berries and leaves to some extent; tonic, aromatic stimulant, diaphoretic; berries for allspice. Dose, gr. 15–60 (1–4 Gm.).

5. *Lau'rus no'bilis*, *Laurel, Sweet Bay*.—The leaves and fruit; Mediterranean Basin. Leaves 5–10 Cm. (2–4') long, pellucid-punctate, smooth, aromatic, astringent; fruit (bayberries) oval drupes 12 Mm. (½') long; contains volatile oil, fixed oil (*Oleum Lauri*) 30 p. c.; stimulant, astringent, stomachic.



RECAPITULATION No. 3.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Santalaceae</i> : 1. <i>Oleum Santali</i> . 2. <i>Oleum Santal</i> .	<i>Santalum album</i> .	The volatile oil.	S. India, E. Indian Islands.	Santalal — $C_{12}H_{22}O$ , Santalol — $C_{15}H_{26}O$ .	.....	Astringent, stimulant, diuretic.	Bronchitis, gonorrhoea, cystitis, pyelitis, diarrhoea.	Minims. 5-20 (3-1.3 Cc.).
<i>Aristolochiaceae</i> : 1. <i>Serpentaria</i> . 2. <i>Serpentaria</i> .	<i>Aristolochia</i> : <i>Serpentaria</i> , <i>reticulata</i> .	The dried rhizome and roots.	United States.	Volatile oil, aristolochine, resin, tannin, starch.	Fluidextr., tinct., tr. cinch. co.	Stimulant, tonic, diaphoretic, antiperiodic.	Pneumonia, intermittents, dyspepsia, diphtheria.	Grains. 5-30 (3-2 Gm.).
<i>Polygonaceae</i> : 1. <i>Rheum</i> . 2. <i>Rhubarb</i> .	<i>Rheum</i> : officinale, palmatum, var. tanguticum.	The dried rhizome.	W. and C. China.	Chrysophanic acid, methylchrysophanic acid, emodin, rhein, rhabarberon, resins (phaeoretin, erythrorutin, aporetin), starch, rheotannic acid, Ca oxalate. Pinene, + $C_{10}H_{16}O$ .	Extr., fluidextr., mixt. rhei et soda, syrup, pills comp., pulv. comp., tinct., ar. tr., ar. syr.	Aperient, purgative, astringent, tonic.	Diarrhoea, hemorrhoids, chronic dysentery, thread-worms, bilious fever.	5-30 (3-2 Gm.).
<i>Chenopodiaceae</i> : 1. <i>Oleum Chenopodii</i> . 2. Oil of <i>Chenopodium</i> .	<i>Chenopodium anthelminticum</i> .	The volatile oil.	W. Indies, C. and S. America.	Pinene, + $C_{10}H_{16}O$ .	.....	Anthelmintic, vermifuge, round-worms.	Worms, intermittents, hysteria, chorea, nervousness, tænia.	Minims. 2-10 (13-6 Cc.).
<i>Phytolaccaceae</i> : 1. <i>Phytolacca</i> . 2. <i>Phytolacca</i> .	<i>Phytolacca decandra</i> .	The dried root.	N. America.	Sugar, Ca oxal., glucoside, tannin, starch, vol. acid.	Fluidextract.	Alterative, laxative, emetic, anodyne, resolvent.	Rheumatism, skin diseases, syphilis, diphtheria, scrofula, hemorrhoids, itch, mange, ringworm.	5-30 (3-2 Gm.).
<i>Myristicaceae</i> : 1. <i>Myristica</i> . 2. <i>Myristica</i> .	<i>Myristica fragrans</i> .	The kernel of the seed.	Moluccus (Spice Islands), India.	Volatile oil, fixed oil, starch, proteids.	Tr. lav. co., tr. rhei ar., ar. pulv., troch. sod. bicarb., acct. opii. Oil.	Stimulant, stomachic, condiment, flavoring, narcotic.	Flatulence, diarrhoea, nausea, colic, dyspepsia, carminative.	5-20 (3-1.3 Gm.).
<i>Ranunculaceae</i> : 1. <i>Hydrastis</i> . 2. <i>Hydrastis</i> .	<i>Hydrastis canadensis</i> .	The dried rhizome and roots.	N. America.	Hydrastine, berberine, canadine.	Glycerite, fluidextr., tincture, hydrochloride.	Alterative, tonic, aperient.	Dyspepsia, costiveness, malaria, jaundice, catarrh, gonorrhoea.	5-30 (3-2 Gm.).

1. Cimicifuga. 2. Cimicifuga.	The dried rhizome and roots.	N. America.	Cimicifugine, resins, fat, tannin.	Extract, fluid-extr., tincture.	Alterative, emmenagogue, sedative.	Bronchitis, rheumatism, amenorrhœa, chorea, dyspepsia.	5-30 (3-2 Gm.).
1. Sassafras. 2. Sassafras.	The ripe seed.	Medicerranean Basin.	Delphinine, delphinofoline, delphinine, staphisagrine, fixed oil.	Fluidextract.	Diuretic, cathartic, rubefacient, poisonous.	Parasiticide, rheumatism, neuralgia, ich., vermin.	1-2 (0.6 Gm.).
1. Aconitum. 2. Aconite.	The dried tuberous root.	Europe; Asia; N. America.	Aconitine, aconitine, pseudoaconitine, resin, aconitic acid.	Fluidextract, tincture.	Sedative, anodyne, poison.	Fever, rheumatism, neuralgia, gout, pneumonia.	1-2 (0.06-1 Gm.).
<i>Berberidaceæ:</i> 1. Berberis. 2. Berberis.	The rhizome and roots.	United States.	Berberine, oxyacanthine, berbamine, resin, tannin.	Fluidextract.	Alterative, diuretic, antiperiodic, tonic, laxative.	Scrofulous, syphilitic skin diseases, dyspepsia, hepatitis, constipation, torpid liver, jaundice.	10-30 (6-2 Gm.).
1. Podophyllum. 2. Podophyllum. <i>Menispermaceæ:</i> 1. Pareira. 2. Pareira.	The dried rhizome and roots. The dried root.	N. America. Brazil, Peru.	Resin-podophyllin, starch, fat. Pelosine, tannin.	Fluidextract, resin, pil. pod., bel. et cap. Fluidextract.	Cathartic, tonic, alterative. Diuretic, tonic, laxative.	Constipation, torpid liver, jaundice. Cystitis, calculi, gonorrhœa, dropsy, rheumatism.	5-15 (3-1 Gm.). 30-60 (2-4 Gm.).
1. Calumba. 2. Calumba.	The dried root.	E. Africa.	Calumbin, berberine, calumbic acid, starch.	Fluidextract, tincture.	Tonic, stomachic.	Dyspepsia, debility, remittent fevers, diarrhœa, phthisis.	5-30 (3-2 Gm.).
<i>Lauraceæ:</i> 1. Sassafras. 2. Sassafras.	The bark of the root.	N. America.	Volatile oil (safrol), sassafrid, starch, resin, tannin.	Fluidextract sars. co., Oil: syr. sars. comp.	Alterative, diaphoretic, stimulant.	Skin diseases, rheumatism, syphilis.	30-60 (2-4 Gm.).
1. Sassafras Medulla. 2. Sassafras Pith.	The pith of the stem.	.....	Mucilage.	Mucilage.	Demulcent.	Conjunctivitis, gastritis, dysentery, throat affections.	60-240 (4-15 Gm.).
1. Cinnamonum. 2. Saigon Cinnamon. 2. Saigon Cinnamon.	Cinnamonum: Zeylanicum and other undetermined species. ..... .....	China, Annam, Java, Sumatra, S. America.	Volatile oil, tannin, sugar, mannite, starch.	Tinct., ar. powd., fluid-extr. ar. powd., tr. card. co., tr. gambir. co., tr. lav. co., vin. opii, Oil: aqua, spirit, inf. dig.	Germicide, antispasmodic, carminative, stimulant, astringent, aromatic.	Parturient, flatulency, diarrhœa, menorrhagia, nausea.	5-30 (3-2 Gm.).
1. Cinnamonum. 2. Ceylon Cinnamon. 1. Camphora. 2. Camphor.	The dextrogyr. ketone.	China, Japan, Formosa.	$C_{10}H_{16}O$ .	Aq. lin., cer., spt., lin. belladon., lin. sap., pulv. morph. co., tr. opii camph., monobromat. of camphor, camphoric acid.	Antispasmodic, stimulant, nervine, diaphoretic, rubefacient, resolvent, antiseptic.	Hysteria, nervousness, diarrhœa, colic, rheumatism, tenesmus, asthma, cough, spasms, nausea, ulcers, scabies.	1-5 (0.6-3 Gm.).

## 31. PAPAVERACEÆ. Poppy Family.

**Pa-pav-e-ra'se-e.** L. *Papaver* + aceæ, poppy, OE. *papy*, Gr. *μῦλον*, classic name, fr. *papa*, pap or thick milk—i. e., formerly used for children, to nourish and cause sleep. Herbs or shrubs, with milky or colored juice. Distinguished by the 2–3 fugacious sepals and minute embryo near base of fleshy albumin; flowers large, in 2's or 4's; petals 4–12; stamens 16 +; ovary compound, 1-celled; anthers 2-celled, superior; fruit capsule; temperate climates; narcotic, emetic, cathartic, acrid poison.

Genera: 1. **Papaver.** 2. **Sanguinaria.**

## OPIUM. OPIUM.

**Papaver  
somniferum, Linné.**

} The concrete milky exudation obtained by incising the unripe capsules, containing 9 p. c. of crystallized morphine.

**Habitat.** W. Asia, (Asia Minor, Persia, China, Africa, India, Italy, Greece, England, United States); cultivated.

**Syn.** Opium Poppy, Poppy, Black, Blue, or Maw Seed Poppy, Meconium, Lachryma Papaveris, Succus Thebaicus, Thebaica; Fr. Pavot officinal, Opium; Ger. Opium, Mohnsaft.

**Pa-pa'ver.** See etymology, above, of Papaveraceæ.

**Som-nif'er-um.** L. *somnus*, sleep, + *ferre*, to bring—i. e., produces sleep.

**O'pi-um.** L. fr. Gr. *ὀπιον*, poppy or vegetable juice.

FIG. 144.



*Papaver somniferum*: 1, ovary with few remaining stamens; 2, ripened capsule; 3, seed; 4, longitudinal section of seed.

**PLANT** (var. *album*).—An annual with thick, branching, yellow root; stem .6–1.3 M. (2–4°) high, 12 Mm. (½') thick, smooth, glaucous, branched; leaves 15–25 Cm. (6–10') long, sessile, oval, tapering at base, variously lobed and toothed, thick, dull green, glaucous, veins prominent, midrib wide, white; flowers February–March, few, large, 7.5–17.5 Cm. (3–7') wide, terminal, silver-gray; sepals 2, green; petals 4, white, yellow, violet; fruit capsule, 3–5, or more, on each plant, nearly globular, 2.5–7.5 Cm. (1–3') wide, filled with laticiferous vessels, flat top and bottom, with neck smooth, glaucous, pericarp yellowish, dehiscing by small apertures beneath the stigmatic crown. **JUICE** (opium), in irregular, flattened, more or less rounded masses of variable size, grayish-brown, covered with remnants of poppy leaves and occasional *Rumex* fruits, somewhat plastic when fresh, becoming harder, internally dark brown, lustrous, showing tears and vegetable tissue fragments; odor strong, narcotic; taste bitter, characteristic. **Solvents**: diluted alcohol; diluted acids; boiling water. **Dose**, gr. 1–2 (.06–.13 Gm.).

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**ADULTERATIONS.**—Sand, bullets, stones, pounded poppy capsules, extract of capsules, extract of herbage, aloes, gum tragacanth, resins, wax, licorice, pitch, starch, sugar, camels' dung, pulp of figs or apricots, acacia, molasses, clay, shot, ashes, gypsum, litharge, charcoal, leaves, stems, moisture, exhausted opium.

**Commercial.**—Homer mentions the poppy as a cultivated garden plant, and even now it is raised for its ornamental flowers. Usually it does not grow wild, but is planted similar to our wheat (Sept.–Oct.), requiring rich soil, manure, and care until the yielding stage; this, the winter crop, unless protected by snow, often is injured, necessitating a resowing (Feb.–March)—the spring crop. Under cultivation several varieties have developed, all being useful. Var. *album* is preferred; var. *ni'grum* has purple or red flowers, smaller, rounder capsules, and black seeds (hence its variety name). All parts of the plant yield milky juice, but the leaves and seeds are without alkaloids, the former natively being used as spinach, the latter for its 50–60 p. c. of bland yellow oil, which is employed for culinary purposes, in pharmacy, etc., instead of olive oil. The plant grows well in our Southern States (Va., S. Ca., Ga., Tenn., etc.), developing considerable narcotic properties at the flowering period.

Opium, however, is collected mainly in Asia Minor, Egypt, etc., May–July, by making, into the unripe (pale yellow) capsules, a few days after the flower falls, one or more transverse or spiral incisions (longitudinal in Japan, India), with a several-bladed knife (*nushtur*), carefully avoiding cutting through the inner capsular diaphragm, in which case juice would be lost by escaping into the centre of the capsule, thereby destroying also the seeds, as well as possibly injuring the plant. Men, women, and children do the incising in the afternoon, whereupon a white juice exudes, which soon concretes into tears. By next morning this is brown, when it is scraped off with knives on to poppy or *Rumex* leaves, wetting the knives occasionally with saliva or oil to prevent adherence. When full the leaves are folded, wrapped with fresh leaves if necessary, and dried for several days in the shade, which should be sufficient at least to avoid moldiness—a very common defect. Small growers sell their product to interior merchants, who pack it in bags with *Rumex* berries to prevent sticking. These are sealed, put into baskets, and forwarded to Smyrna, Constantinople, etc., where it is sold upon physical examination; it is then transferred to buyers' underground warehouses, where it is cured or doctored. The growers sometimes manipulate the tears into a homogenous mass with mortar and pestle, giving *homogeneous opium* (Egypt, India); or more frequently the separate masses merely are pressed together as agglutinated tears, yielding *granular opium* (Asia Minor, Persia); or an aqueous extract of spent capsules and leaves may be mixed with the pure juice.

The most important commercial varieties are:

1. Turkey, Asia Minor (*P. somniferum* var. *album* and *glabrum*).—  
(a) Smyrna: best, most common in our market, in round or flat lumps

$\frac{1}{2}$ –2 pounds (.2–1 Kg.), with tears like seeds on the inside, and capsular epidermis 5–8 p. c., hence has not been manipulated or kneaded; yield 10–13 p. c. morphine. (b) Constantinople: resembles Smyrna, only has no tears or capsular epidermis, but, like it, also comes from the northern opium districts of Anatolia, in round or flat lumps  $\frac{1}{2}$ –3 pounds (.2–1.2 Kg.); yield 10–13 p. c. morphine; extract, 50 p. c. From this port come also the rich opiums of Gévê, Magnesia, Salonica, Bithynia, Amasia, Malatia, in 1–5 ounce (.03–.15 Kg.) packages.

2. *Egyptian* (*P. somniferum* var. *glabrum*).—In flat, roundish cakes 2.5–15 Cm. (1–6') wide, 2–16 ounces (.06–.5 Kg.); has no *Rumex* capsules; brittle, not tenacious like the Smyrna; hard in the centre as on the surface, fracture conchoidal, waxy lustre, redder than Smyrna; yield 6–7 p. c. morphine.

3. *India*.—Seldom reaches our market, but mostly exported to China; in round balls, 4 pounds (2 Kg.), with 12 Mm. ( $\frac{1}{2}$ ') outside hard coating of leaves and poppy petals agglutinated with extract of juice and washings, then dried—*Provision opium*; or moulded into flat, square, or in circular cakes 4–8 ounces (.12–.24 Kg.), wrapped in oiled paper—*Abkari opium*. Juice here being kept unshaped, ferments, yielding a hard, brittle, blackish product, showing oily spots; yield 5.7 p. c. morphine, unusually rich in narcotine, 3–4 p. c.; extract 70 p. c.

4. *Persian, Trebizond* (*P. somniferum* var. *album*).—In cylindrical sticks 7.5 Cm. (3') long, 12 Mm. ( $\frac{1}{2}$ ') thick, wrapped in glossy paper, tied with cotton thread,  $\frac{1}{2}$ – $\frac{3}{4}$  ounce (15–23 Gm.) each, or usually in short, rounded cones 6–10 ounces (.18–.3 Kg.), or in flat circular cakes, slightly agglutinated, liver-brown color, like Egyptian, softens in damp weather; taste very bitter, oily from linseed oil (instead of spittle) used on the incising knives; yield 8–12 p. c. morphine.

5. *Chinese*.—In flat, darkish, globular cakes, in white paper, prepared, no doubt, by artificial heat, less oily than Persian, used entirely at home; annual production 40,000,000 pounds (18,181,800 Kg.), double the combined output of all the other varieties; in addition to this the natives consume all of the Indian and much Persian in their vicious practices of smoking and chewing.

6. *French*.—Consisted of agglomerated tears, no impurities; was grown chiefly by Aubergier, during his lifetime, under the name *Affium*; no longer in commerce; yield 14–23 p. c. morphine.

Opium has been introduced into Algeria, Mozambique (African) for Chinese trade, Bulgaria, Australia, and into New England. This latter product has been ruled out of trade owing to its excessive adulteration, but in recent years there has been manufactured in our country a "pudding," so-called *Boston opium*, of high grade appearance, yet containing admixtures so as just to come within the U. S. P. limit. During the Civil War opium was cultivated in Virginia, Tennessee, South Carolina, Georgia, being planted in September and collected in May. *Factitious opium* is a blackish aqueous extract of the plant, being nearly odorless and tasteless. London is the distributing

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point, as the English control its production and levy a tax upon its sale for the development of India, etc. Our entrepôts are New York and San Francisco.

**CONSTITUENTS.**—Morphine (1816) 2.5–15–22.8 p. c., Narcotine (1803–1817) 1.3–10 p. c., Codeine (1832) 0.2–0.7 p. c., Narceine (1832) 0.02–0.1–0.7 p. c., Pseudomorphine (1835) 0.2 p. c., Thebaine (1835) 0.15–1 p. c., Papaverine (1848) 1 p. c., and 12 other alkaloids, all combined with either sulphuric or meconic acid, 4 p. c.; also contains glucose, mucilage, pectin, caoutchouc, wax, fat, coloring and odorous principles, lactic acid (1.25 p. c.), meconin,  $C_{10}H_{10}O_4$ , meconiosin,  $C_8H_{10}O_2$ , ash 6 p. c.

**Morphina, Morphine,  $C_{17}H_{19}NO_3 + H_2O$ , official.**—(Syn., Morphia, Morphinum; Fr. Morphine; Ger. Morphinum, Morphin.) This, the first alkaloid known, is obtained by exhausting opium with water, concentrating, filtering, adding alcohol, ammonia water, setting aside to crystallize; dissolving crystals in hot alcohol, treating with animal charcoal, crystallizing; or may treat concentrated filtered infusion with calcium chloride, evaporate filtrate, when morphine and codeine crystallize out, narcotine, etc., remaining in mother-liquors; occurs in colorless, or white shining rhombic prisms, or fine needles, or crystalline powder, odorless, bitter, permanent, soluble in 3,330 parts water, 100 lime water, 168 alcohol, 4,464 ether, 1,800 chloroform. *Tests:* 1. With nitric acid—orange-red fading to yellow (dif. from quinine), bleached by oxidizing agents (dif. from brucine). 2. With ferric chloride T. S.—blue color, destroyed by acids, alcohol, or heating. 3. With sulphuric acid—slight yellowish tint (abs. of narcotine, papaverine); + potassium iodate crystal—dark brown, but codeine—moss-green, narcotine—cherry-red; + potassium dichromate—green color (abs. of strychnine)—purple, acetanilide—crimson changing to green. 4. With potassium hydroxide T. S. get clear solution (abs. of and dif. from other alkaloids), no ammonia odor (abs. of ammonium salts). 5. With diluted hydrochloric acid + ferric chloride T. S., no red color (abs. of meconic acid, meconates). Dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.008–.016 Gm.).

**Morphinæ Acetas, Morphine Acetate,  $C_{17}H_{19}NO_3.HC_2H_3O_2 + 3H_2O$ , official.**—(Syn., Morphinæ Acetas, Acetas Morphinicus, Morphinum Aceticum; Fr. Acétate de Morphine; Ger. Morphinum Aceticum, Morphinacetat, Essigsäures Morphin.) Obtained by mixing freshly precipitated alkaloid with water and dissolving in slight excess of diluted acetic acid, carefully evaporating to dryness; occurs as a white, or yellowish-white, crystalline or amorphous powder, faintly acetous odor, bitter, soluble in 2.25 parts water, 21.6 alcohol, 480 chloroform, 5.2 glycerin, insoluble in ether, no residue upon ignition. *Tests:* 1. With sulphuric acid get acetous vapors; aqueous solution + excess diluted ammonia water yields white precipitate (morphine). Should be kept in well-stoppered, dark amber-colored vials, and should contain a minute quantity of free acetic acid to prevent decomposition. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.008–.016 Gm.).

**Morphinæ Hydrochloridum, Morphine Hydrochloride,  $C_{17}H_{19}$ —**

$\text{NO}_3\text{HCl} + 3\text{H}_2\text{O}$ , *official*.—(Syn., Morphine Hydrochloras, U. S. P. 1890, Morphine Hydrochlorate, Morphine Murias; Fr. Chlorhydrate de Morphine; Ger. Morphinum hydrochloricum, Morphinhydrochlorid, Salzsäures Morphin.) Obtained by mixing the alkaloid with boiling distilled water, adding diluted hydrochloric acid until dissolved and neutral, concentrating until crystals appear; occurs in white, silky, glistening needles or microcrystalline cubes, or white, crystalline powder, odorless, bitter, permanent, soluble in 17.2 parts water, 42 alcohol, insoluble in ether, chloroform, no residue upon ignition. *Tests*: 1. With excess of ammonia water get white precipitate (morphine); with potassium carbonate T. S. get white precipitate soluble in chloroform without color (abs. of apomorphine). Should be kept in well-stoppered, amber-colored vials. Dose, gr.  $\frac{1}{8}$ — $\frac{1}{4}$  (.008–.016 Gm.).

**Morphine Sulphas, Morphine Sulphate**,  $(\text{C}_{17}\text{H}_{19}\text{NO}_3)_2\text{H}_2\text{SO}_4 + 5\text{H}_2\text{O}$ , *official*.—(Syn., Morphine Sulphas, Sulphas (Sulfas) Morphinicus; Fr. Sulfate de Morphine; Ger. Morphinum sulfuricum, Morphinsulfat, Schwefelsäures Morphin.) Obtained by mixing alkaloid (1) with boiling water (2), adding diluted sulphuric acid until dissolved and neutral, setting aside to crystallize; occurs in white, feathery, acicular, silky crystals, or in cubical masses, odorless, bitter, permanent, no residue upon ignition, soluble in 15.3 parts of water, 465 alcohol, insoluble in ether, chloroform. *Tests*: 1. Aqueous solution + excess diluted ammonia water gives white precipitate (morphine). Should be kept in well-stoppered, amber-colored vials. Dose, gr.  $\frac{1}{8}$ — $\frac{1}{4}$  (.008–.016 Gm.).

**Apomorphine Hydrochloridum, Apomorphine Hydrochloride**,  $\text{C}_{17}\text{H}_{17}\text{NO}_2\text{HCl}$ , *official*.—(Syn., Apomorphine Hydrochloras, U. S. P. 1890, Apomorphine Hydrochlorate; Fr. Chlorhydrate d'Apomorphine; Ger. Apomorphinum hydrochloricum, Apomorphinhydrochlorid.) This hydrochloride of the artificial alkaloid is prepared by heating morphine (or codeine) 2–3 hours at  $149^\circ\text{C}$ . ( $300^\circ\text{F}$ .), in a sealed glass tube with about 20 parts of pure hydrochloric acid; after cooling dilute the liquid in the tube with water and add sodium bicarbonate to precipitate apomorphine, treat precipitate with ether or chloroform, to which add a little hydrochloric acid, when crystals form; it is morphine deprived of one molecule of water. It is in minute grayish-white monoclinic prisms, glistening, odorless, slightly bitter taste, greenish upon exposure, soluble in 39.5 parts water, 38.2 alcohol, 1,864 ether, 3,800 chloroform, decomposed at  $210^\circ\text{C}$ . ( $410^\circ\text{F}$ .). *Tests*: 1. With nitric acid get deep purple, fading to orange; with sulphuric acid no change; with both acids blood-red, fading to orange. 2. Diluted ferric chloride T. S. gives red (dif. from morphine—blue). 3. 0.05 Gm. shaken with 10 Cc. water -- 0.05 Gm. ferrous sulphate, gradually turns blue, then black, + alcohol, solution resumes blue color (dif. from codeine, morphine, narceine, narcotine). 4. If in 100 parts water have emerald-green color when shaken, it should be rejected (showing oxidation). Should be kept in small, dark amber-colored bottles, having been rinsed with hydrochloric acid and dried; solutions should be freshly made with a

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little hydrochloric or acetic acid to prevent decomposition. Dose, expectorant, gr.  $\frac{1}{40}$ – $\frac{1}{25}$  (.0015–.0025 Gm.); emetic, gr.  $\frac{1}{16}$ – $\frac{1}{8}$  (.004–.008 Gm.).

**Codeina, Codeine**,  $C_{17}H_{19}(CH_3)NO_3 + H_2O$ , *official*.—(Syn., Codeia, Methyl Morphine; Fr. Codeine; Ger. Codeinum, Kodein, Codein.) Obtained from opium by precipitating infusion with chalk and calcium chloride, when chlorides of morphine and codeine crystallize out; dissolve these in water, add ammonia, when morphine crystallizes, evaporate filtrate for codeine; if instead of ammonia we use potassium or sodium hydroxide, codeine will be precipitated and morphine remain in solution; may obtain it also synthetically from morphine by methylation—acting upon alkaline solution of morphine with methyl iodide or chloride, or sodium methylsulphate, hence it is methyl morphine. It is in white, or nearly translucent, orthorhombic prisms, octahedral crystals, or crystalline powder, odorless, faintly bitter taste, efflorescent, soluble in 88 parts water, 1.6 alcohol, 12.5 ether, 0.66 chloroform, at 100°C. (212° F.) loses water of crystallization, no residue, levogyrate, forms numerous salts (hydrochloride, nitrate, sulphate, etc.). *Tests*: 1. Sulphuric acid + trace ferric chloride gives violet-blue color; sulphuric acid heated + 1 drop nitric acid gives blood-red; sulphuric acid + trace selenous acid gives green, changing to blue, then grass-green (morphine gives blue, then green and brown); sulphuric acid gives no color change, + 1 drop formaldehyde solution gives violet-blue (morphine intense purple). 2. 0.05 Gm. added to 2 Cc. nitric acid causes crystals to turn red, but acid acquires only a yellow (dif. from and abs. of morphine). *Impurities*: Morphine, nitrous compounds. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

**Codeinæ Phosphas, Codeine Phosphate**,  $(C_{18}H_{21}NO_3)_2H_3PO_4 + 2H_2O$ , *official*.—(Syn., Fr. Phosphate de Codéine; Ger. Codeinum phosphoricum, Kodeinphosphat.) Obtained by dissolving 10 parts codeine in 12.5 phosphoric acid (25 p. c.), leaving solution slightly acid, adding alcohol sufficient to precipitate. It is in fine, white, needle-shaped crystals, or crystalline powder, odorless, bitter taste, soluble in 2.25 parts water, 261 alcohol, 1,350 ether, 6,620 chloroform. *Tests*: 1. Silver nitrate T. S. gives yellow precipitate, soluble in diluted nitric acid and in ammonia water. 2. Potassium ferricyanide crystal + 10 Cc. water, + 1 drop ferric chloride T. S., gives no blue color at once (abs. of morphine). *Assay*: 0.2 Gm. in 5 Cc. water, + 3 potassium hydroxide T. S., shaken out successively with 3 portions chloroform (5 Cc. each), then chloroformic solutions evaporated to dryness, should yield 0.13 Gm. of codeine. *Impurities*: Morphine, nitrous compounds. Should be kept in well-stoppered, amber-colored bottles. Considered the best salt for hypodermic use, as it is more soluble and less irritating. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.); injection, gr.  $\frac{1}{4}$ – $\frac{3}{4}$  (.02–.05 Gm.).

**Codeinæ Sulphas, Codeine Sulphate**,  $(C_{18}H_{21}NO_3)_2H_2SO_4 + 5H_2O$ , *official*.—(Syn., Fr. Sulfate de Codéine; Ger. Codeinum sulfuricum, Kodeinsulfat.) Obtained by dissolving 100 Gm. codeine in warm water, adding sufficient sulphuric acid (16.54 Gm.) to get neutral liquid.



concentrate, allow to crystallize. It is in long, glistening, white, needle-shaped crystals, rhombic prisms, or crystalline powder, efflorescent; odorless; bitter taste, soluble in 30 parts water, 1,035 alcohol, insoluble in chloroform, ether; gives reactions of codeine and sulphates. *Impurities*: Morphine, nitrous compounds. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

**Narcotine**,  $C_{22}H_{23}NO_7$ .—Obtained from an aqueous solution by shaking, or from opium itself by macerating with ether or chloroform; occurs in tasteless, colorless, shining, rhombic crystals; soluble in ether, chloroform, benzene, hot alkaline solutions; dissolves blood-red in sulphuric acid containing some nitric acid; heated with nitric acid gives meconin,  $C_{10}H_{10}O_4$ , cotarnine,  $C_{12}H_{13}NO_3$ , and opianic acid,  $C_{10}H_{10}O_5$ ; forms salts (hydrochloride, sulphate, etc.). Dose, gr. 1–3 (.06–.2 Gm.).

**Narceine**,  $C_{23}H_{29}NO_9$ .—Long, silky needles, bitter, sparingly soluble in cold alcohol and water, insoluble in ether; with warm diluted sulphuric acid get violet and cherry-red; with nitric acid get transiently yellow; with iodine blue; with Fröhde's reagent brown-yellow; forms salts (hydrochloride, nitrate, sulphate, etc.). Dose, gr.  $\frac{1}{3}$ – $\frac{3}{4}$  (.02–.05 Gm.). The four alkaloids, morphine, codeine, narcotine, and narceine, may be extracted from any given sample of opium by shaking the concentrated infusion with ether—taking out narcotine; add alkali in excess to filtrate, which redissolves morphine and narceine, leaving codeine deposited; from filtrate allow morphine to crystallize, and in mother-liquor have narceine, to be obtained by evaporation.

**Meconic Acid**,  $C_7H_4O_6$ .—Occurs free and in combination with the alkaloids; obtained by adding calcium chloride to opium infusion; this precipitate of calcium meconate is washed with hot water, alcohol, and treated with hydrochloric acid; filtrate deposits meconic acid upon cooling. *Tests*: 1. With ferric chloride T. S. get blood-red color, not discharged by dilute hydrochloric acid (dif. from acetic and formic acids), or by chlorides of gold or mercury (dif. from sulphocyanates).

**Assay**: Exhaust opium (10 Gm.) with distilled water (320 Cc.), evaporate (to 14 Gm.), pour into Erlenmeyer flask, add alcohol (12.2 Cc.), shake, + ether (25), shake, + ammonia water (3.5), shake, set aside 6 hours, pour ethereal solution on filter, wash crystals with two portions ether (each 10 Cc.), transfer crystals to filter using water (15 Cc.), wash crystals with few drops water, then with few drops morphine-alcohol, then with ether (10 Cc.), dry, weigh; shake crystals in flask with lime water (10 Cc. for each 0.1 Gm. morphine), filter, shake with portions of lime water until no precipitate with mercuric potassium iodide T. S., dry, weigh contents, deduct insoluble matter on filter from weight of impure morphine crystals, difference  $\times 10 =$  p. c., crystallized morphine present.

**PREPARATIONS**.—I. *Opium Granulatum*. Granulated Opium, *officinal*.—(Syn., Fr. Opium Grenelé; Ger. Granulirtes Opium.) Opium dried at  $85^\circ$  C. ( $185^\circ$  F.), reduced to coarse (No. 20) powder, and containing 12–12.5 p. c. crystallized morphine. Dose, gr. 1–2 (.06–.13 Gm.).

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II. *Opium Pulvis*. Powdered Opium, *official*.—(Syn., Fr. Poudre d'Opium; Ger. Opiumpulver.) Opium dried at 85° C. (185° F.), reduced to very fine powder, and containing 12–12.5 p. c. crystallized morphine. In purchasing granulated or powdered opium, should the strength be greater than 12 p. c., a proportionately less quantity can be used in preparations; thus, of 17 p. c. opium only  $70\frac{3}{5}$  Gm. need be used wherever U. S. P. directs the 100 Gm.— $17 : 12 :: 100 : x$ , or  $x = 70.59$  Gm. Dose, gr. 1–2 (.06–.13 Gm.).

1. *Acetum Opium*. Vinegar of Opium. (Syn., Black Drop; Fr. Vinaigre d'Opium; Ger. Opiumessig.)

*Manufacture*: 10 p. c. Macerate 7 days powdered opium 10 Gm., nutmeg 3, in diluted acetic acid 50 Cc., strain, express, mix residue with diluted acetic acid 20, strain, express, dissolve in mixed and filtered liquids sugar 20 Gm., add through filter diluted acetic acid q. s. 100 Cc. Dose,  $\mathfrak{M}\text{v}$ –20 (.3–1.3 Cc.).

2. *Extractum Opium*. Extract of Opium. (Syn., Aqueous Extract of Opium, *Extractum Thebaicum*; Fr. Extrait (d'Opium) thébaïque; Ger. Opiumextrakt.)

*Manufacture*: 20 p. c. morphine. Exhaust powdered opium 100 Gm. with water, evaporate filtrate and washings to 200 Gm., when cold weigh, add 12 Gm. to an Erlenmeyer flask, determine by assay amount of morphine present; dry 5 Gm. to determine amount of water; from results calculate quantity of morphine and water in remainder of extract, add sugar of milk sufficient to make amount of morphine 20 p. c. of dry extract, evaporate to dryness, powder, transfer to small, well-stoppered bottles. *Assay*: Dissolve extract 4 Gm. in water (30), evaporate filtrate and washings to 10 Gm., pour into Erlenmeyer flask, and proceed approximately as in assay of opium. Dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.).

*Prep.*: 1. *Emplastrum Opium*. Opium Plaster. (Syn., Emp. Opiatum, Emp. Cephalicum, Emp. Odontalgicum; Fr. Emplâtre d'Opium, Emplâtre céphalique (temporal, odontalgique, calmant); Ger. Opiumpfaster, Hauptpfaster.)

*Manufacture*: Rub extract of opium 6 Gm. with water 8 Cc., until uniform, add this to melted adhesive plaster 90 Gm., heat until product weighs 100 Gm.

3. *Tinctura Opium*. Tincture of Opium, Laudanum. (Syn., *Tinctura Thebaica*, *Tinctura Meconii*; Fr. Teinture (de Extrait d'Opium) thébaïque; Ger. *Tinctura Opium simplex*, Einfache Opiumtinktur.)

*Manufacture*: 10 p. c. Add to granulated opium 10 Gm. boiling water 40 Cc., weigh, stir occasionally for 12 hours, restore original weight with water, add alcohol 40 Cc., macerate 2 days, occasionally shaking, percolate with liquid until clear and then with diluted alcohol q. s. 100 Cc.; when assayed each 100 Cc. should contain 1.2–1.25 Gm. of crystallizable morphine. *Assay*: Evaporate 100 Cc. to 20 Cc., add water 40, after 1 hour filter, wash same until washings clear, evaporate these to small volume, also first filtrate, the whole to weigh 14 Gm., and proceed approximately as in assay of opium, except omitting the final multiplication by 10. Dose,  $\mathfrak{M}\text{v}$ –20 (.3–1.3 Cc.).

4. *Tinctura Opii Deodorati*. Tincture of Deodorized Opium. (Syn., *Tinctura Opii Deodorata*.)

*Manufacture*: 10 p. c. Add to granulated opium 10 Gm. boiling water 50 Cc., stir mixture frequently for 1 day, percolate with liquid until clear and then with water until exhausted, evaporate to 15 Cc., cool, shake 10 minutes with purified petroleum benzin 6.5, then again with benzin 1, separate and evaporate all traces of benzin, mix with water 60, filter, add alcohol 20, wash filter with water q. s. 100 Cc. *Assay*: Identical with that of the tincture. Dose,  $\mathfrak{M}\nu$ -20 (.3-1.3 Cc.).

Prep.: 1. *Tinctura Ipecacuanhæ et Opii*. Tincture of Ipecac and Opium. (Syn., Tincture of Dover's Powder.)

*Manufacture*: Evaporate tinct. opii deod. 100 Cc. to 80, add fluid-extract ipecac and diluted alcohol  $\text{aa}$  10 Cc. Dose,  $\mathfrak{M}\nu$ -20 (.3-1.3 Cc.).

5. *Tinctura Opii Camphorata*. Camphorated Tincture of Opium, Paregoric. (Syn., Paregoric Elixir; Br. *Tinctura Camphoræ Composita*, Compound Tincture of Camphor; Fr. *Tinctura Extracti Opii Camphorata*, Teinture d'Opium camphrée, Elixir parégorique; Ger. *Tinctura Opii benzoica*, Benzoësäurehaltige Opiumtinktur.)

*Manufacture*:  $\frac{2}{3}$  p. c. Macerate 3 days, frequently agitating, powdered opium .4 Gm., benzoic acid .4, camphor .4, oil of anise .4 Cc., glycerin 4, diluted alcohol q. s. 100 Cc., filter. Dose,  $\text{zss}$ -2 (2-8 Cc.).

Prep.: 1. *Mistura Glycyrrhizæ Composita*, 12 p. c.

6. *Vinum Opii*. Wine of Opium. (Syn., Sydenham's Laudanum, Laudanum Liquidum Sydenhami; Fr. *Vinum Opii Compositum*, Vin d'Opium composé; Ger. *Tinctura Opii crocata*, Safranhaltige Opiumtinktur.)

*Manufacture*: 10 p. c. Macerate 7 days, occasionally agitating, granulated opium 10 Gm., saigon cinnamon 1, cloves 1, with alcohol 15 Cc., white wine 85, filter in a well-covered funnel, adding menstruum q. s. 100 Cc. Dose,  $\mathfrak{M}\nu$ -20 (.3-1.3 Cc.).

7. *Pilule Opii*. Pills of Opium. (Syn., Br. *Pilula Saponis Composita*; Fr. *Pilules d'Opium*; Ger. *Opiumpillen*.)

*Manufacture*: Powdered opium 6.5 Gm., soap 2, water q. s. 100 pills. Dose, 1-2 pills.

8. *Pulvis Ipecacuanhæ et Opii*. Powder of Ipecac and Opium. (Syn., Dover's Powder, Compound Powder of Ipecacuanha; Br. *Pulvis Ipecacuanhæ Compositus*; Fr. *Poudre de Dover*; Ger. *Pulvis (Ipecacuanhæ opiatus) Doveri*, Doversches Pulver.)

*Manufacture*:  $\text{aa}$  10 p. c. Powdered opium 10 Gm., ipecac 10, milk-sugar 80. Dose, gr. 5-10 (.3-.6 Gm.).

9. *Trochisci Glycyrrhizæ et Opii*. Troches of Glycyrrhiza and Opium. (Syn., Trochisci Opii, Opium Lozenges; Fr. *Pastilles d'Opium*, Pastilles de Réglisse opiacées; Ger. *Opiumpastillen*.)

*Manufacture*: Powdered opium .5 Gm., extract glycyrrhiza 15, acacia 12, sugar 20, oil of anise .2 Cc., water q. s. 100 troches. Dose, 1-4 troches.

10. *Opium Deodoratum*. Deodorized Opium. (Syn., Opium Denarcotisatum; Fr. *Opium (Denarcotiné) sans Odeur*; Ger. *Desodorirtes (Denarcotinirtes) Opium*.)

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*Manufacture*: 12–12.5 p. c. morphine. Macerate powdered opium 100 Gm. with sufficient purified petroleum benzin to cover it, shaking occasionally, decant, repeat treatment with benzin, decant, percolate residue with benzin until it passes without color, expose powder to air in order to dry. Benzin is much better than ether, as it removes the odorous matter (caoutchouc, wax, fat, etc.), which so often cause nausea and discomfort, without affecting the narcotine. Should be kept in well-stoppered bottles. Dose, gr. 1–2 (.06–.13 Gm.).

II. *Morphinæ Sulphas*—*official*. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.008–.016 Gm.).

1. *Pulvis Morphinæ Compositus*. Compound Powder of Morphine. (Syn., Tully's Powder, *Pulvis Camphoræ Compositus* Tully; Fr. *Poudre de Tully*; Ger. *Tullysches Pulver*.)

*Manufacture*: Morphine sulphate 1.5 Gm., camphor 32, glycyrrhiza 33, precipitated calcium carbonate 33.5, alcohol q. s. to pulverize the camphor. Dose, gr. 5–10 (.3–.6 Gm.).

*Unoff. Preps.*: *Extractum Opii Liquidum* (Br., 3.75 p. c. of extract). *Linimentum Opii* (Br., 50 p. c. of tincture). *Pulvis Opii Compositus* (Br., 10 p. c.). *Tinctura Opii Ammoniata* (Br., 15 p. c. of tincture); *Liquor Morphinæ Sulphatis*, official 1870 ( $\frac{1}{4}$  p. c.), dose, 3j–2 (4–8 Cc.). *Magendie's Solution of Morphine*, 4 p. c.; if benzoic acid or phenol (carbolic acid,  $\frac{3}{4}$  p. c.) be added to this latter solution, it will not spoil nor irritate hypodermically; dose, Mv–10 (.3–.6 Cc.). *Chlorodyne* (morphine hydrochloride .5 Gm., water 2 Cc., diluted hydrochloric acid 2, chloroform 6, tincture cannabis indica 4, diluted hydrocyanic acid 1, alcohol 16, oil of peppermint 1, oleoresin of capsicum .05); dose, Mv–15 (.3–1 Cc.) in water, poisonous. *Oleatum Morphinæ*, 10 p. c. + oleic acid 90 p. c., use externally. *Injectio Apomorphinæ Hypodermica* (Br., 1 p. c.). *Injectio Morphinæ Hypodermica* (Br., 5 p. c.). *Liquor Morphinæ Acetatis*, *Liquor Morphinæ Hydrochloridi*, and *Liquor Morphinæ Tartratis* (Br., each 1 p. c.). *Suppositoria Morphinæ* (Br., each contains  $\frac{1}{4}$  gr.; .016 Gm.). *Troches of Morphine and Ipecac*, each contains morphine sulphate  $\frac{1}{4}$  gr. (.0016 Gm.) + ipecac  $\frac{1}{8}$  gr. (.005 Gm.). *Trochiscus Morphinæ* (Br., each contains  $\frac{1}{8}$  gr.; .0018 Gm.). *Syrupus Codeinæ* (Br., .46 p. c.).

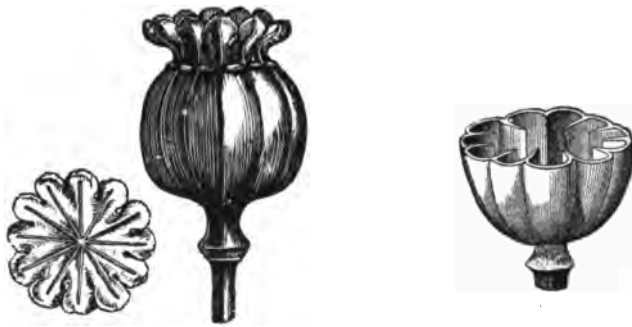
**PROPERTIES.**—Narcotic, sedative, anodyne, antispasmodic, hypnotic, diaphoretic, chiefly due to morphine. Narcotine is antiperiodic, tetanizing, hypnotic without being narcotic, hence name should have been anarcotine. Narceine resembles morphine, but is more hypnotic, with less after-effects—headache, constipation, etc. Codeine is hypnotic, tetanic, less constipating and active than morphine, often contaminated with other alkaloids, used for bronchial coughs and in diabetes. Thebaine or Paramorphine is soporific, spinal excitant, tetanizer, resembling strychnine in action. Papaverine is hypnotic, sedative, convulsant.

Opium in full doses, gr. 1–3 (.06–.2 Gm.), produces dry mouth, thirst, stimulates brain by increasing blood supply, arrests digestion by reducing bile, gastric and pancreatic juice secretion; causes nausea, vomiting, sweating, depressed circulation and respiration, lower temperature, contracted pupil, retention of urine, profound sopor, or,

instead, coma-vigil and delirium with delightful dreams. After-effects are nausea, depression, constipation, headache, vertigo, nasal pruritus.

USES.—To relieve pain, except in acute inflammation of the brain ; to cause sleep in insomnia of low fevers ; to allay irritation, to check secretions—diarrhœa, dysentery, diabetes ; to support system in low fevers, etc. ; also for peritonitis, cerebro-spinal meningitis, cholera morbus, delirium tremens, mania spasms, melancholia, sciatica, neuralgia, cancer, renal and hepatic colic from calculi, cough without secretion ; to lock bowels when required by inflammation, hemorrhages, dyspnœa, angina pectoris, cerebral anæmia ; morphine hypodermically for consumption, chronic catarrh, asthma, diabetes, typhoid fever, dysenteric tenesmus, epilepsy, hysteria, croup, bronchitis, dysmenorrhœa. Externally opium applied in poultices for gout, rheumatism, ophthalmia, odontalgia, periodontitis, inflamed gums and mucous membrane of mouth. Young children are very susceptible to its narcotic effects, and to such it should be given cautiously ; women are affected much

FIG. 145.



Poppy capsule, showing internal septa.

easier than men. Some individuals possess idiosyncrasy toward it, being on the one hand easily, on the other with difficulty, brought under its influence ; others cannot tolerate the smallest dose ; many animals accept it *ad libitum*—ducks, chickens, pigeons, monkeys, etc.

**Poisoning:** Have mental excitement, increased heart action, slow, irregular, stertorous respiration, cold, clammy sweats, headache, deep sleep, contracted pupils, face reddened, then bluish, slow pulse and dilated pupils as the end approaches, lost reflexes ; jaw falls, muscular relaxation, coma, death finally by paralyzed respiration ; the more contracted the pupils the more serious, while vomiting and free perspiration are favorable symptoms. In apoplexy pupils are unequal, in alcoholism they are normal or dilated, in chloroform widely dilated ; the odor of breath and vomited matter will often aid diagnosis. Give tannic acid or vegetable astringents (strong coffee or tea), then evacuate the stomach (pump, apomorphine, zinc sulphate, ipecac, etc.), or wash it out with a warm solution of potassium permanganate (using twice the

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amount of salt as of morphine ingested, then atropine (strychnine), caffeine, cocaine, digitalis, brandy, spirit of nitrous ether, amyl nitrite) to maintain circulation and respiration; faradization, cold douches, ambulation, flagellation; it is eliminated by the kidneys, consequently catheterize the bladder often to prevent reabsorption, and keep the patient awake.

*Incompatibles:* Alkalies, alkaline carbonates, lime water, tannic acid and vegetable preparations containing it, salts of lead, iron, copper, mercury, and zinc, Fowler's solution, atropine, strychnine, coffee, caffeine, tartar emetic, digitalis; with morphine: iodine, iodides, bromine, bromides, sodium borate.

*Synergists:* Alcohol, hydrated chloral, belladonna, cocaine, ipecac.

*Opium-habit or Disease:* To this, thousands of weak and strong-minded have fallen prey, including such eminent characters as Coleridge, Robert Hall, John Randolph, De Quincey, Wilkie Collins, etc. By some thought to be a habit, which may be cured by gradually lessening the quantity or by stopping off abruptly, substituting for a time tonics, hyoscine and stimulants—ginger, capsicum, black pepper, quassia, calumba, diluted phosphoric acid, tincture lupulin, etc. Others consider it a disease amenable to systematic systemic treatment in hospitals, etc., where hygiene, tonics, strychnine, atropine, quinine, iron and gold salts are relied upon mainly.

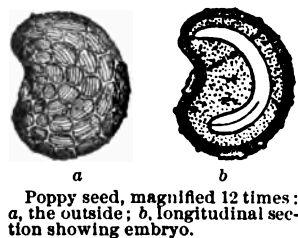
*Opium-test:* Heat the gum, which, becoming fluid, runs when tilted from dung, mineral and vegetable matters, evaporate this heavy liquid to a powder; of this take gr. 25 (1.6 Gm.) + water ʒiv (15 Cc.), triturate, if stiff or mucilaginous—starch, flour, gum, saleg; add water ʒij (60 Cc.), filtrate should be wine-yellow—no extract licorice; mixture should be acid—no ashes, chalk, litharge; evaporate to ʒj (30 Cc.), add potassium ferrocyanide or twice quantity alcohol, should get no precipitate—no heavy metal or gums; the insoluble residue should be gr. 10–11½ (.6–.7 Gm.), or 100 parts should yield 55–60 parts of aqueous extract.

*Allied Products:*1. *Papaveris Capsulæ*, *Poppy Capsules*,

*Papaver*, *Poppy*.—The nearly ripe capsules, official 1840–1880. These are collected in August and September, when nearly ripe, inverted to keep the juice from escaping, and dried in kilns about 12 hours. From these, deprived of seeds, can make an extract

and syrup, and, including the seeds, a decoction. Capsules or heads are the size of hen's egg to one's fist, and contain morphine .2–2 p. c. Syrup used for coughs; decoction for demulcent to sprains, bruises, etc.

FIG. 146.



Poppy seed, magnified 12 times:  
a, the outside; b, longitudinal section showing embryo.

FIG. 147.



*Papaver Rhæas*.

2. *Seed*.—When black called *maw* seeds; not narcotic, yield 40–60 p. c. fixed oil, which is used as food, for burning in lamps, by painters, instead of olive oil; expressed cake for cattle, seeds for birds.

3. *Exhausted gum*, for poultices as anodyne applications.

*Allied Plants*:

1. *Papaver Rhœ'as*, *Rhœados Petala*, *Red-Poppy Petals* (Br.).—Europe; flowers large, beautiful red, petals mainly used for their coloring-matter, which is yielded to water; its milky juice is sedative, demulcent, mild anodyne, probably due to *rhœadine*, also contains two coloring principles—*rhœadic* and *papaveric* acids. Syrupus *Rhœados* (Br.), 22.5 p. c. Dose, ʒss–1 (2–4 Cc.).

2. *Argemone mexicana*, *Prickly Poppy*.—Capsules and leaves contain berberine, fumarine, but no morphine; seeds have a bland, light yellow fixed oil 36 p. c.; substitute for castor oil. Dose, ℥xv–45 (1–3 Cc.).

## SANGUINARIA. SANGUINARIA.

**Sanguinaria**  
**canadensis**, Linné. } The dried rhizome, collected after the death of the foliage.

*Habitat*. N. America—Canada, United States, in open woods on rich soil.

*Syn*. Blood Root, Indian Red Paint, Red Paint Root, Red Root, Coon Root, Snake-bite, Indian Paint, Pauson, Red Puccoon, Tetterwort; Fr. Sanguinaire; Ger. Blutwurzel.

**San-gui-na'ri-a**. L. *sanguinarius* fr. *sanguis*, blood—i. e., all of the plant-parts abound in, and when injured emit a blood-like juice.

**Can-a-den'sis**. L. Canadian, belonging to Canada—i. e., habitat, abundant there.

**PLANT**.—Perennial herb putting forth in spring a rounded palmate, 7–9-lobed leaf and a slender scape 10–20 Cm. (4–8') high, bearing large, single, white flower; leaves 7.5 Cm. (3') long, 10–12.5 Cm. (4–5') wide, heart-shaped at base, reniform, light green, glaucous beneath, whitish, veins 7–9, reddish; sepals 2, fugacious; petals 8–12, white; fruit June, capsule or pod, oblong, many-seeded. **RHIZOME**, of horizontal growth, cylindrical, often branched, 2–7 Cm. ( $\frac{1}{2}$ –3') long, 5–15 Mm. ( $\frac{1}{8}$ – $\frac{3}{8}$ ') thick, reddish-brown, slightly annulate, fracture short, somewhat waxy, brownish-red or yellowish-white, with many reddish resin-cells; odor slight, the powder sternutatory; taste persistently acid, bitter; powder reddish, with numerous bright red resin-cells, starch grains roundish, mostly single. All parts contain orange-colored sap, of deepest color in the rhizome. Rapidly deteriorates with age. *Solvents*: alcohol; diluted acetic acid; water. Dose, expectorant, gr. 1–8 (.06–.5 Gm.); emetic, gr. 15–30 (1–2 Gm.).

**CONSTITUENTS**.—Chelerythrine, Sanguinarine, Protopine (fumarine),  $\beta$ -Homochelidonine, resin, starch, citric and malic acids, ash 8 p. c.

**Chelerythrine**,  $(C_{21}H_{17}NO_4)_2 \cdot H_2O + C_6H_5CH_3$ , and **Sanguinarine**,  $C_{20}H_{15}NO_4 + \frac{1}{2}C_2H_5OH$ .—Obtained by exhausting the rhizome with a 2 p. c. acetic acid menstruum, adding ammonia water in excess, thereby precipitating chelerythrine, sanguinarine, protopine, resin, and coloring-matter, leaving in filtrate homochelidonine. This precipitate,

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when purified, is a yellowish-brown, sternutatory powder, having a variable solubility in alkaloidal solvents (alcohol, chloroform, acetone, ether, benzol); alcoholic solutions are reddish-brown; chloroform and acetone solutions are yellowish; ether and benzol are nearly colorless, giving a blue fluorescence. Exhaust powder with ether, evaporate; the light brown residue when boiled with alcohol changes into a white crystalline powder; this is dissolved in chloroform, and mixed with an equal quantity of alcohol, spontaneous evaporation in a few days gives fine colorless crystals, melting at  $263^{\circ}\text{C}$ . ( $505^{\circ}\text{F}$ .) (chelerythrine), separating out among a mass of reddish crystals, melting at  $211^{\circ}\text{C}$ . ( $412^{\circ}\text{F}$ .) (sanguinarine); both alkaloids are purified, when chelerythrine occurs in greater amount, and in colorless crystalline crusts, yielding yellow salts with acids, while sanguinarine is in much the less quantity, in fine needles, yielding intensely red salts. Dose (sanguinarine), expectorant, gr.  $\frac{1}{12}$ — $\frac{1}{8}$  (.005–.008 Gm.); emetic, gr.  $\frac{1}{4}$ — $\frac{1}{2}$  (.015–.03 Gm.); properties with the drug.

**Protopine**,  $\text{C}_{28}\text{H}_{19}\text{NO}_5$ .—Obtained by treating impure sanguinarine with chloroform-alcohol, when it crystallizes out either as hemispherical wart-like aggregates of fine needles, or as well-developed colorless prisms; or free original filtrate from resin, add ammonia water, shake out with chloroform, evaporate, dissolve amorphous residue in hot acetic ether; it melts at  $206^{\circ}\text{C}$ . ( $403^{\circ}\text{F}$ .), and gives with sulphuric acid deep purple color.

**Homochelidonine**,  $\text{C}_{21}\text{H}_{23}\text{NO}_5$ .—Obtained by freeing the original filtrate from resin, adding ammonia water, shaking out with chloroform; evaporate, and dissolve amorphous residue in hot acetic ether, when upon cooling wart-like crystals (protopine) separate out, and also crystals which melt at  $155^{\circ}\text{C}$ .;  $311^{\circ}\text{F}$ . ( $\beta$ -homochelidonine); protopine is almost insoluble

FIG. 148.

*Sanguinaria canadensis.*



in acetic ether, while homochelidonine is very soluble, a property which renders the alkaloids easily separable.

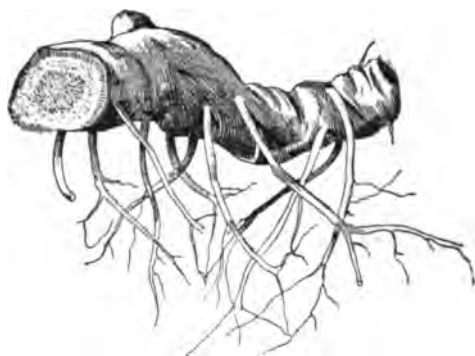
**Resin**—yields protocathechuic acid.

**PREPARATIONS.**—1. *Fluidextractum Sanguinariae*. Fluidextract of Sanguinaria. (Syn., *Extractum Sanguinariae Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Sanguinaire*; Ger. *Flüssiges Blutwurzeln-extrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with water 72.5 Cc. + acetic acid 27.5, finishing with same menstruum q. s., evaporate to 100 Cc. Dose, ℥j-5;—10-30 (.06-.3;—.6-2 Cc.).

2. *Tinctura Sanguinariae*. Tincture of Sanguinaria. (Syn., Fr. *Teinture de Sanguinaire*; Ger. *Blutwurzeltinktur*.)

FIG. 149.



*Sanguinaria* rhizome, showing cross-section.

*Manufacture*: 10 p. c. Moisten 10 Gm. with acetic acid 2 Cc. + 30 Cc. alcohol 60 p. c.; macerate, percolate with alcohol 60 p. c., q. s. 100 Cc. Dose, ℥v-60;—3j-2 (.3-4;—4-8 Cc.).

*Unoff. Preps.*: *Acetum*, 10 p. c., dose, ℥x-30;—3j-4 (.6-2;—4-15 Cc.). *Infusion*, 5 p. c., dose, ʒss-4 (15-120 Cc.).

**PROPERTIES.**—Systemic emetic, stimulating expectorant (increasing broncho-pulmonary mucus), tonic, alterative, sialagogue, sternutatory, emmenagogue, cardiac paralyzer, violent irritant, acro-narcotic poison. Small doses excite the stomach, increase the circulation, while large doses nauseate and depress the pulse; full doses vomit actively; when inhaled causes violent sneezing.

**USES.**—Bronchitis, croup, asthma, pneumonia, chronic nasal catarrh (tincture ℥x; .6 Gm. at a dose), atonic dyspepsia with torpid liver, jaundice, duodenal catarrh, amenorrhœa, syphilis. Externally the powdered drug or juice to ulcers, warts, scaly and pustular eruptions, nasal polypi.

*Poisoning*: Have violent emesis, salivation, catharsis, burning in stomach, thirst, faintness, vertigo, dim vision, dilated pupils, reduced

**CRUCIFERÆ.**

temperature, cold sweats, slow weak irregular pulse, great prostration, death from paralysis of heart and respiratory centres, often preceded by convulsions. Wash out the stomach, give diffusible stimulants freely, amyl nitrite; morphine and atropine to antagonize depression of circulation and local irritation (pain and nausea).

*Allied Plants:*

1. *Chelido'nium ma'jus*, *Chelidonium*, *Celandine*.—The entire plant, collected when beginning to flower, official 1880–1900; Europe, N. America. Perennial light green plant, .6 M. (2°) high, emitting when wounded a saffron-yellow, opaque juice; leaves pinnate, 10–20 Cm. (4–8') long; flowers yellowish; root reddish-brown, several-headed, branching; fruit capsule, linear, 2-valved; seed numerous; odor unpleasant when fresh; taste acrid; contains chelerythrine, chelidonine,  $\alpha$ - and  $\beta$ -homochelidonine, chelidoxanthin, sanguinarine, protopine, chelidonic (jervic) acid, chelidoninic (ethylenesuccinic) acid, gum, chlorophyll; solvents: water, alcohol. Cathartic, diuretic, diaphoretic, expectorant; used by ancients as now for jaundice, dropsy, intermittent fever, scrofula, skin diseases; externally—warts, corns, eczema, urticaria, itching eruptions; fresh herb in amenorrhœa, as a vulnerary. Dose, dried plant, gr. 15–60 (1–4 Gm.); fresh plant, ʒj–2 (4–8 Gm.); extract, gr. 10 (.6 Gm.); fluidextract, ʒss–1 (2–4 Cc.); infusion, 5 p. c., ʒj–2 (30–60 Cc.); expressed juice (fresh plant), ℥x–20 (.6–1.3 Cc.).



*Chelidonium majus*: showing fruit, flowers, ovary, and seed.

2. *Glaucium Glaucium (lu'teum)*, *Yellow Horned Poppy*, and *G. corniculatum*.—Both are similar to chelidonium; contain yellow juice and nearly identical alkaloids, hence used for about the same purposes.

3. *Dicentra canadensis*, *Corydalis*, *Turkey Corn*.—Fumariaceæ; Canada to Ky. Small perennial; tubers often in 3's, 6–10 Mm. (¼–¾') thick, yellowish, horny, bitter; corydaline, fumaric acid, bitter extractive, resin, starch. Tonic, diuretic, alterative; syphilitic, scrofulous and cutaneous affections. Dose, gr. 10–30 (.6–2 Gm.).

**32. CRUCIFERÆ. Mustard Family.**

Kru-sif'e-re. L. *Crucifer*, fem. pl. fr. *cru(x)c*, a cross, + *ferre*, to bear—i. e., flowers (petals) arranged in shape of maltese cross. Herbs or shrubs. Distinguished by pungency or acrid juice, cruciform flowers, tetradynamous stamens, fruit a silique or silicle, 2-celled; sepals 4; petals 4; stamens 6, of which 2 are shorter and inserted lower down; pistil 1, compound, superior; seed albuminous; temperate, frigid, and tropical climates; antiscorbutic, pungent, acrid (fixed and volatile oils).

Genera: 1. *Sinapis*. 2. *Brassica*.

## SINAPIS. MUSTARD.

1. SINAPIS ALBA. White Mustard.

2. SINAPIS NIGRA. Black Mustard.

1. *Sinapis alba*, Linné.  
 2. *Brassica nigra*, (Linné) Koch. } The seed.

*Habitat.* Asia, S. Europe, cultivated in gardens; wild in United States.

*Syn.* 1. Charlock, Kedlock, Yellow Mustard; Br. *Sinapis Albæ* Semina; Fr. Moutarde blanche; Ger. Semen Erucæ, Weisser Senfsemen. 2. Red Mustard, Cadlock, Kerlock; Br. *Sinapis Nigræ* Semina; Fr. Moutarde noire (grise); Ger. Semen Sinapis, Senfsamen, Schwarzer Senf.

*Si-na'pis.* L. fr. Gr. (σι) νανι, Celtic *nap*, a turnip.

*Bras'si-ca.* L. for cabbage, fr. Celtic *bresic*, cabbage—i. e., the fruit resemblance.

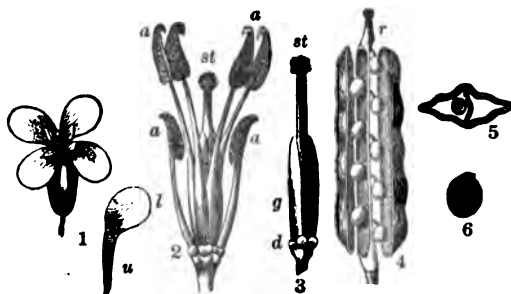
*Al'ba.* L. *albus*, white—i. e., the seed.

*Ni'gra.* L. *niger*, black—i. e., the seed.

*Mus'tard.* L. *mustum*, must—i. e., seeds were once pounded with must or vinegar.

PLANTS.—1. *Sinapis alba*, *White Mustard*.—Erect annual, .6 M. ( $2^{\circ}$ ) high, branches few, ascending, stiff, green, bristly, with reflexed hairs; leaves stalked, pinnatifid, hairy, 3-lobed, dentate; flowers June, yellow, racemes; fruit silique, 2.5–4 Cm. ( $1-1\frac{3}{8}'$ ) long, 5 Mm. ( $\frac{1}{8}'$ ) wide, bristly; ribbed, beak long, sword-shaped, 4–6-seeded, dehiscing by 2 valves; roots fusiform, thin, branching. SEED, 1–2 Mm. ( $\frac{1}{32}-\frac{1}{12}'$ ) thick, subglobular, testa yellowish, minutely pitted, embryo yellowish, oily, with curved hypocotyl, 2 conduplicate cotyledons; inodorous; taste mildly pungent, acrid; powder contains few or no starch grains. *Test*: 1. Exhaust 1 Gm. with alcohol, boil 'marc + water 200 Cc., cool, add water q. s. 1,000 Cc., the addition of 4 Cc. iodine V. S. should not produce dark blue color (lim. of starch).

FIG. 151.



*Brassica nigra*: 1, flower; 2, pistil and stamens; 3, pistil; 4, silique; 5, cross-section of same; 6, seed; a, stamen; st, stigma; g, pistil carpels; d, nectar tubes; r, replum.

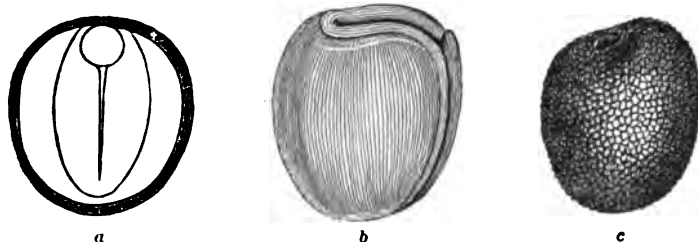
2. *Brassica nigra*, *Black Mustard*.—Similar to *Sinapis alba*, except that it is 1.3 M. ( $4^{\circ}$ ) high, smooth above, leaves irregularly pinnatifid, faintly toothed, flowers half as large, 6 Mm. ( $\frac{1}{4}'$ ) wide; fruit 18 Mm. ( $\frac{3}{4}'$ ) long, linear, appressed to axis of raceme, somewhat quadrangular, beak short, tapering, 3–7-seeded. SEED, 1 Mm. ( $\frac{1}{25}'$ ) thick, subglobu-

## CRUCIFERÆ.

lar, testa deep red-brown, sometimes with grayish tinge minutely pitted, embryo greenish-yellow, oily, with curved hypocotyl, 2 conduplicate cotyledons; odor while dry, slight, on moistening, powerfully irritating; taste strongly pungent, acrid; powder contains few or no starch grains. *Test*: 1. Same as white mustard (starch). *Solvents*: water; alcohol slightly (for both species). Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—**SEED**: With those of allied species—radish, turnip, rape, the latter being most prevalent, and easily recognized by its larger size and peculiar bluish-red tint; **POWDER**: Flour, starchy substances, turmeric, sawdust; out of 27 samples examined only 8 were found free of admixtures, which may be detected by microscope, starch-test, etc.; white mustard distinguished by not giving pungent fumes when mixed with water, unless heated.

FIG. 152.



*Sinapis*, magnified: a, transverse section; b, embryo; c, entire seed.

**Commercial.**—White mustard is mostly a wild weed, flourishing in fields of corn under tillage; cultivated, however, in England and United States. Black mustard, though wild, is extensively cultivated natively. Both varieties of seeds yield yellow powder, of characteristic odor and taste, by grinding and sifting. When the two are powdered and mixed, we have *mustard* or *flour of mustard* (*Sinapis*, Br.); if ground with water or vinegar and spices, we get semi-solid *French mustard*.

**CONSTITUENTS.**—1. **WHITE MUSTARD**: Fixed oil 20–25 p. c., Sinalbin, Sinapine sulphocyanide, lecithin, albumin 28 p. c., gum and mucilage 19 p. c. (mainly in testa), myrosin, other proteids, ash 4 p. c.

**Fixed Oil.**—Obtained by crushing seeds and expressing; it is yellowish-green, non-drying, sp. gr. 0.916, congeals  $-18^{\circ}\text{C}$ . ( $0^{\circ}\text{F}$ .), slight odor, bland, mild taste, consists of glycerides of oleic, stearic, erucic, and behenic acids.

**Sinalbin.**— $\text{C}_{30}\text{H}_{44}\text{N}_2\text{S}_2\text{O}_{16}$ .—Extracted by alcohol, is in colorless prisms, soluble in water, sparingly in alcohol, yellow by alkali, red with nitric acid; in the presence of water the ferment myrosin acts upon it, yielding glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , sinapine sulphate,  $\text{C}_{16}\text{H}_{23}\text{NO}_5\cdot\text{H}_2\text{SO}_4$ , and acrinyl sulphocyanide,  $\text{C}_7\text{H}_7\text{O}\cdot\text{NCS}$  (yellow, acrid, non-volatile oil), soluble in alcohol, ether.

**Sinapine.**—Alkaloid, here only as sulphocyanide, in colorless, bitter prisms; soluble in water, alcohol. Sinapine boiled with alkalis gives choline or sinkaline,  $C_3H_{15}NO_2$ , and sinapic acid,  $C_{11}H_{12}O_5$ .

2. **BLACK MUSTARD:** Fixed oil 30–35 p. c., Sinigrin (Potassium myronate) 0.7–1.3 p. c., Sinapine sulphocyanide, lecithin, albumin 30 p. c., gum and mucilage 20 p. c. (mainly in testa), myrosin, other proteids, ash 4 p. c.

**Sinigrin**,  $KC_{10}H_{18}NS_2O_{10}$ .—Silky, white needles, or golden-yellow crystals, soluble in water, slightly in alcohol, insoluble in ether, chloroform; with water and the ferment myrosin it splits into glucose, acid potassium sulphate, and allyl sulphocyanide (volatile oil of mustard) 0.56 p. c.

**Oleum Sinapis Volatile.** Volatile Oil of Mustard, *official.*—(Oleum Sinapis Æthereum, Oil of Mustard; Fr. Essence de Moutarde; Ger. Oleum Sinapis, Senföl, Ätherisches Senföl.) This oil, like oil of bitter-almond, does not preëxist in the plant; it is obtained by macerating with water the crushed black mustard seed (*B. nigra* or *B. juncea*), after expressing the fixed oil, when a reaction takes place between sinigrin and myrosin, then distilling— $KC_{10}H_{18}NS_2O_9$  (sinigrin) +  $H_2O = C_3H_5NCS$  (volatile oil of mustard) +  $C_6H_{12}O_6$  +  $KHSO_4$ ; in addition are formed also allyl cyanide, carbon disulphide, allyl thiocyanate, and higher boiling compounds, which are always present in the oil; this oil is largely prepared synthetically by decomposing allyl iodide,  $C_3H_5O$ , with potassium sulphocyanate in alcoholic solution. It is a colorless or yellowish, limpid, strongly refractive liquid, pungent, acrid odor and taste (in both exercise great caution, examining it only when diluted), sp. gr. 1.020, soluble in alcohol, volatile at  $150^\circ C.$  ( $302^\circ F.$ ); contains at least 92 p. c. of allyl isothiocyanate (isosulphocyanate), with traces of allyl cyanide, carbon disulphide, etc. *Tests:* 1. Oil 3 Gm. + 6 Gm. sulphuric acid gradually added and kept cool, upon shaking will get  $SO_2$  evolved, liquid will remain light yellow, at first clear, afterwards thick, occasionally crystalline, pungent odor of oil disappears. 2. Distil oil at  $148$ – $152^\circ C.$  ( $298$ – $306^\circ F.$ ), the first and last distillate should have same sp. gr. as original oil (abs. of alcohol, chloroform, petroleum, fatty oils, carbon disulphide). 3. Dilute oil with 5 volumes alcohol, + 1 drop ferric chloride T. S. should not get blue or violet color (abs. of phenols). *Assay:* Weigh 2 Gm. oil, add alcohol sufficient that 50 Cc. will represent 1 Gm. oil; of this transfer 5 Cc. to a 100 Cc. measuring flask, add 30 Cc.  $\frac{N}{10}$  silver nitrate V. S., 5 Cc. ammonia water, well stopper, set aside in dark 24 hours, dilute with water to 100 Cc. mark, filter; to 50 Cc. filtrate add 4 Cc. nitric acid, few drops ferric ammonium sulphate T. S. + sufficient  $\frac{N}{10}$  potassium sulphocyanate V. S. to produce permanent red color, which should be not more than 5.6 Cc. (each Cc.  $\frac{N}{10}$  silver nitrate V. S. consumed corresponds to 0.00492 Gm. allyl isothiocyanate). Should carefully be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $m \frac{1}{8}$ – $\frac{1}{4}$  (.008–.016 Cc.).

## CRUCIFERÆ.

**Myrosin.**—This ferment is an albuminoid body, and becomes inert at 65° C. (149° F.), hence mustard heated to this point will not yield the volatile oil, for which reason mustard plasters should not be moistened with water warmer than the body temperature.

**ADULTERATIONS.**—**SEED**: Seeds of some allied species; **POWDER**: Farinaceous substances, wheat flour (blue with iodine), turmeric, which renders white mustard flour even whiter (blue with iodine, reddish-brown with borax or boric acid), red pepper to increase pungency; **OIL**: Alcohol, carbon disulphide, castor oil, petroleum, artificial allyl isosulphocyanate, etc.

**PREPARATIONS.**—**BLACK MUSTARD**: 1. *Charta Sinapis*. Mustard Paper. (Syn., Fr. Papier moutarde (sinapisé), Moutarde en feuilles; Ger. Charta sinapisata, Senfpapier.)

**Manufacture**: Percolate black mustard 100 Gm. with petroleum benzin until percolate gives no greasy stain on blotting paper, dry the powder; dissolve rubber 10 Gm. in petroleum benzin and carbon disulphide each 100 Cc., with this mix the purified mustard to produce semi-liquid magma, spread upon thick, well-sized paper, allow surface to dry; 60 □ Cm. contains 4 Gm. oilless mustard.

**Unoff. Preps.**: **SEED**: *Infusion*, 5 p. c., dose, *ad libitum*. **OIL**: *Compound Liniment*, 3 p. c. *Linimentum Sinapis* (Br.), 4 p. c. *Spiritus Sinapis* (Ger.), 2 p. c.

**PROPERTIES.**—Stimulant, emetic, tonic, diuretic, laxative, rubefacient, irritant, epispastic, carminative, condiment, vesicant; dilates the vessels, causing redness, warmth, and irritates sensory nerves, giving burning pain.

**USES.**—Atonic dyspepsia with constipation, delirium tremens, atonic dropsy, hiccough, narcotic poisoning. Externally—rheumatism, gout, atrophy, neuralgia, colic, gastralgia, inflammation of throat or lungs, toothache, earache, headache, vomiting, diarrhœa, dysentery, amenorrhœa, dysmenorrhœa, stimulant to heart, respiration, and vascular system.

**For mild action**: Dilute mustard with equal quantity of flaxseed meal or flour, and with water make it into a pasty plaster, poultice, cataplasm, or sinapism, so variously called. These should be applied enveloped in very thin muslin to prevent sticking, and are almost entirely superseded by the whole- and half-strength *mustard leaves*, which, in order to use, should be dipped into warm water for 15 seconds and applied for ½–1 hour. The volatile oil may be applied locally, well diluted (3ss; 2 Cc. + Stokes' liniment, alcohol, or almond oil ʒij; 60 Cc.). Good in scabies, hysteria, swooning convulsions.

**Mustard foot-baths**, good in headache, cerebral and other internal congestion, pneumonia, amenorrhœa, for diaphoresis.

The infusion, made by stirring a tablespoonful to a cream with warm water, is useful for emetic in poisoning, etc., giving the entire mixture.

*Allied Plants :*

1. *Brassica jun'cea*, *Sarepta*, *Indian*, *Russian Mustard*.—S. Russia, Africa, India, from this latter country exported into Europe; seed closely resemble the official black mustard, and have the same constituents. *B. arven'sis* (*Sinapis'trum*), *Charlock*, *Wild Mustard*, Europe, United States; an annual, troublesome weed; seed smoothish, dark brown, smaller and less pungent than our official black mustard.

FIG. 153.

*Brassica campestris.*

2. *B. campestris*.—Europe, Russian Asia. Wild annual, .3–.6 M. (1–2°) high, flowers bright yellow; of this we have several cultivated varieties which give us edible roots and seeds of some value, thus: (a) var. *Na'pus*, *Turnip*—seed larger than official black mustard, 1.6–2 Mm. ( $\frac{1}{16}$ – $\frac{1}{12}$ ') thick, brown or black, finely pitted, slightly acid; (b) var. *Ra'pa*, *Rape*, *Colza*—seed larger than mustard or turnip, 2–2.5 Mm. ( $\frac{1}{12}$ – $\frac{1}{10}$ ') thick, finely pitted, blue-black, slightly acid; both yield a bland, yellow fixed oil under

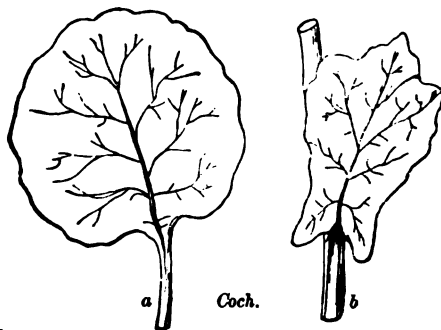
the names of turnip-seed oil and rape-seed oil; (c) var. *Rutaba'ga*, *Swedish Turnip*—seed also small and contains oil and pungency.

3. *Armoracia Radix*, *Horseradish Root* (Br.).—The fresh root of *Rori'pa* (*Cochlea'ria*) *Armora'cia*, U. S. P. 1820–1860; E. Europe, cultivated. Plant .6–1 M. (2–3°) high, in moist places; leaves 20–30 Cm. (8–12') long, 10–12.5 Cm. (4–5') wide, toothed; flowers white;

FIG. 154.

*Roripa Armoraria*: flower: s, calyx; p, corolla; a, stamen; g, fruit carpel; n, stigma.

FIG. 155.

*Roripa Armoracia*: leaves: a, radical; b, cauline.

fruit 2-celled pod, each 4–6-seeded; root 30 Cm. (12') long, 12–25 Mm. ( $\frac{1}{3}$ –1') thick, conical, yellowish, scaly, warty, inside white, many stone-cells, central pith, pungent odor when bruised; taste sharp, acid; contains volatile oil 0.05 p. c. (isomeric with mustard oil,  $C_3H_5NCS$ ), resin. Used as condiment, rubefacient, stimulant, diuretic, for dyspep-

**HAMAMELIDACEÆ.**

sia, rheumatism, dropsy, palsy, scurvy, hoarseness, vomiting; in infusion, spirit (Spiritus Armoracæ Compositus (Br.), 12.5 p. c.), cataplasm. Dose, gr. 20–30 (1.3–2 Gm.); spirit, ʒj–2 (4–8 Cc.).

4. *Raph'anus Raphanis'trum*, Wild Radish, Jointed Charlock, and *R. sati'vus*, Garden Radish.—Both contain a fixed oil resembling that from mustard, but the sulphuretted volatile oil of the latter differs in some respects.

**33. HAMAMELIDACEÆ. Witch Hazel Family.**

Ham-a-me-li-da'se-e. L. *Hamamel(is)-id* + *aceæ*, fr. Gr. *ἄμα*, together with, + *μήλον*, fruit (apple)—i. e., flowers and fruit together on the tree. Shrubs, trees. Distinguished by fragrant balsamic properties; ovary inferior, 2-celled, consisting of 2 pistils united below, forming 2-beaked, 2-celled, woody capsule; ovules 1 in each cell, pendent from cell apex, becoming bony seed; stamens 8, 4 perfect, 4 scale-like, sterile; flowers, heads or spikes, sometimes apetalous; calyx and petals 4–5; temperate climates, tropics; bitter, astringent, acrid, balsamic.

Genera: 1. *Hamamelis*. 2. *Liquidambar*.

**HAMAMELIS. HAMAMELIS.**

1. *HAMAMELIDIS CORTEX. HAMAMELIS BARK.*

2. *HAMAMELIDIS FOLIA. HAMAMELIS LEAVES.*

*Hamamelis* } 1. The bark and twigs.  
*virginiana*, Linné. } 2. The dried leaves, collected in autumn.

*Habitat.* N. America, in thickets, ditch banks; Canada, United States, Minn. to La.

*Syn.* *Hamamelis* (leaves), U. S. P. 1890, Witch-hazel, Wych-hazel, Winter Bloom, Striped (Spotted) Alder, Snapping Hazel Nut, Tobacco Wood, Pistachio; Fr. *Hamelis*; Ger. *Zauberhasel*.

*Ham-a-me'lis.* L. see etymology, above, of *Hamamelidaceæ*.

*Vir-gin-i-a'na.* L. Virginian, of or belonging to Virginia, its original habitat.

*Witch-ha'zel.* *Witch*, from twigs being used in days of witchcraft as divining rods to indicate hidden springs, ores, etc., + *hazel*, resembling hazel tree.

**PLANT.**—Woody shrub 1.5–4.5 M. (5–15°) high, 7.5–15 Cm. (3–6') thick; stem crooked; flowers Sept.–Oct., greenish-yellow; fruit nut or capsule, 2-celled, 2-beaked with 1 bony, oily, edible, black seed in each cell, not ripening until September of following year, when new flowers are blooming, hence generic name, when ripe bursting elastically by hygroscopism into 2 pieces, hurling the seed with considerable force to some distance. **BARK AND TWIGS**, in irregularly quilled or bent pieces, 1–2 Mm. ( $\frac{1}{25}$ – $\frac{1}{12}$ ') thick, grayish-brown, with many lenticels, or reddish-brown, with short transverse ridges or scars, or somewhat scaly in old bark, thin corky layer easily removed from pale cinnamon-colored middle bark, inner surface pale cinnamon or yellowish, smooth or finely striate, fracture short (young) or tough (old) in the bast layer; odor faint; taste astringent, bitter, pungent; twigs flexible, tough,



irregular length, 6 Mm. ( $\frac{1}{4}$ ') thick, branching, or bearing nodes every 2–5 Cm. ( $\frac{1}{3}$ –2'), yellowish-brown to deep purplish-brown, lightly wrinkled longitudinally, with scattered small circular whitish or pale lenticels, bark one-fifth the radius, wood greenish-white, lightly radiate, exhibiting 1–3 annual rings, pith centric, small. LEAVES, short petiolate, inequilaterally obovate or oval, about 10 Cm. (4') long, 6 Cm. ( $2\frac{1}{2}$ ') wide, base slightly heart-shaped and oblique, coarsely sinuate, upper surface pale or brownish-green, under surface light green, with satiny lustre, midrib and veins prominent, the few hairs with thick

FIG. 156.



*Hamamelis virginiana*: A, flowering twig; B, fruit-bearing twig; 2, sepal and stamen; 3, sepal, outer surface; 4, essential organs; 5, pistil; 6, fruit; 7, seed (four last longitudinal sections); 8, floral diagram.

walls and small lumen, petiole short, stout, odor slight; taste astringent, aromatic, bitter. *Solvents*: boiling water; diluted alcohol. Dose, 3ss–1 (2–4 Gm.).

**CONSTITUENTS.**—Tannin, volatile oil, bitter principle, extractive.

**PREPARATIONS.**—I. BARK: 1. *Aqua Hamamelidis*. Hamamelis Water. (Syn., Witch-hazel Water, Witch-hazel Extract; Br. *Liquor Hamamelidis*, Solution of Hamamelis; Fr. *Eau de Hamamelis*; Ger. *Hamameliswasser*.)

*Manufacture*: Macerate 24 hours hamamelis bark 1,000 Gm. in water 2,000 Cc., then distil until 850 Cc. distillate obtained, add alcohol 150,

**HAMAMELIDACEÆ.**

mix thoroughly. *Test*: 1. Add to 1 Cc. sulphuric acid 5 Cc. containing a little salicylic acid, no red should appear (abs. of formaldehyde). Dose, ʒj-4 (4-15 Cc.); mostly externally.

II. **LEAVES**: 1. *Fluidextractum Hamamelidis Foliorum*. Fluidextract of Hamamelis Leaves. (Syn., Extractum Hamamelidis Fluidum, U. S. P. 1890; Br. Extractum Hamamelidis Liquidum; Fr. Extrait liquide de Hamamélis; Ger. Flüssiges Hamamelisextrakt.)

*Manufacture*: Macerate, percolate hamamelis leaves 100 Gm. with alcohol 30 Cc., water 60, glycerin 10, finishing with alcohol 33 p. c. q. s., evaporate to 100 Cc. Dose, ℥xv-60 (1-4 Cc.).

*Unoff. Preps.*: *Decoction*, 5 p. c., dose, ʒj-2 (30-60 Cc.). *Extract*, dose, gr. 5-10 (.3-.6 Gm.). *Tinctura Hamamelidis* (Br.), 10 p. c., dose, ʒss-1 (2-4 Cc.). *Unguentum Hamamelidis* (Br.), 10 p. c. of liquid extract.

**PROPERTIES**.—Astringent, hæmostatic, styptic, sedative, tonic. Acts on the muscular fibres of the veins; large doses produce severe throbbing headache.

**USES**.—It was used first by the North American Indians for external inflammations, congestions, and now for same purposes, as also for hemorrhages of nose, gums, piles, bladder, stomach, rectum, tumors, hemorrhoids, varicose veins, diarrhœa, dysentery.

The Pond's Extract and Distilled Extract (*Aqua Hamamelidis* (*Spirituosa*)) are approximately identical, both being colorless, and employed indiscriminately as external applications for sprains, bruises, excoriations, pharyngitis, rhinitis, leucorrhœa, gonorrhœa, ulcers, skin diseases, etc.

**STYRAX. STORAX.**

**Liquidambar**  
**orientalis, Miller.** } A balsam, obtained from the wood and inner bark.

*Habitat*. Asia Minor; forms entire forests.

*Syn.* Oriental Sweet Gum, Lordwood; Br. *Styrax Præparatus*, Prepared Storax, Balsamum Styracis; Fr. *Styrax liquide*; Ger. *Storax liquidus*, Flüssiger Storax.

**Liquid-am-bar**. L. *liquidus*, liquid, fluid, + Ar. *ambar*, amber—i. e., the color or fragrant, terebinthinate juice or resin (balsam) resembles liquid amber.

**O-ri-en-tal'is**. L. oriental, pertaining to the Orient, or East—i. e., its habitat.

**Styrax**. L. for storax, Gr. *στύραξ*, altr. of Ar. *asshi'arak*, sweet-smelling exudation—i. e., a tree producing it.

**PLANT**.—Tree 6-15 M. (20-50°) high, resembling our sweet-gum; bark purplish-gray; leaves palmately 5-divided, each division obscurely 3-lobed, 5-7.5 Cm. (2-3') long, 10-12.5 Cm. (4-5') wide, margin serrate, bright green, smooth; flowers monœcious, in yellowish solitary heads. **BALSAM** (storax), semi-fluid, gray, sticky, opaque, on standing depositing heavier dark brown stratum; transparent in thin layers; odor agreeable; taste balsamic, insoluble in water, soluble, except impurities, in equal weight of hot alcohol, which solution, upon evaporation, should yield brown, semi-liquid balsamic residue 70 p. c., almost completely soluble in ether, carbon disulphide, insoluble in benzin.

Becomes more fluid by heat; then, if shaken with warm benzin, the supernatant liquid cooled, being colorless, will deposit white crystals of cinnamic acid and cinnamic esters. *Test*: 1. Storax dissolved in warm alcohol, this exhausted with benzin by shaking, evaporated, gives a residue (45–55 p. c.) of blue opalescence, agreeable odor, but if turpentine present get larger residue of a yellow color and terebinthinate odor. *Solvents*: alcohol; ether. *Dose*, gr. 10–30 (.6–2 Gm.).

**ADULTERATIONS.**—Turpentine, sand, ashes, bark, mineral matter 13–18 p. c., water 10–20 p. c.

**Commercial.**—The balsam is not a physiological, but a pathological, secretion of the sapwood, existing only in injured trees as a result of wound stimulation—nature's method of securing antiseptis and healing. To obtain storax in quantity the outer bark on one side of the

FIG. 157.

*Liquidambar orientalis.*

tree is bruised, resulting shortly thereafter in filling the cambium with rows of balsam glands and the inner bark with their exudation. The dead outer bark is taken off and rejected, while the inner is removed and boiled in sea-water—the balsam being skimmed from the surface with final expression of the boiled bark. It was once believed to be produced in the inner bark, and formerly was collected by throwing this into pits, where some exudation took place, with ultimate pressure in strong horse-hair bags. Liquid storax is then put into barrels, goat skins, etc., and forwarded to Constantinople, Smyrna, Syria, Alexandria, Bombay, and Trieste. The greatest demand comes from India and China, the English-speaking people using but little of it. The residual bark when dried (*Cortex Thymiamatis*) is used for fumigation.

**CONSTITUENTS.**—Styrol, Styracin, Phenylpropyl Cinnamate, Storacin, Cinnamic Acid,  $C_9H_8O_2$ , 6–12 p. c., benzoic acid, ethyl cinnamate,  $C_9H_7(C_2H_5)O_2$ , ethyl vanillin, water and other impurities 25–30 p. c.

## HAMAMELIDACEÆ.

**Styrol, Styrene, Styrolene** (*cinnamene, phenyl-ethylene*),  $C_8H_8$ .—Hydrocarbon (volatile oil); obtained by distilling with water. It is a colorless fragrant oily liquid, sp. gr. 0.906, boils at  $145^{\circ} C.$  ( $293^{\circ} F.$ ), and when heated to  $200^{\circ} C.$  ( $392^{\circ} F.$ ) is converted into solid meta-cinnamene.

**Styracin, Cinnamyl Cinnamate**,  $C_9H_7(C_9H_9)O_2$ .—This is obtained in faint yellow crystals, by alcohol, ether, or hot benzene from the resin, after removal of cinnamic acid; with concentrated potassium hydrate solution yields *styrone* (cinnamic alcohol),  $C_9H_{10}O$ , yellowish oily refractive aromatic liquid.

**Phenylpropyl Cinnamate**,  $C_9H_7(C_9H_{17})O_2$ .—This is a thick inodorous liquid.

**Storesin**,  $C_{36}H_{58}O_3$ .—This is the most abundant constituent of storax; it is amorphous, readily soluble in benzin, melts near  $145^{\circ} C.$  ( $293^{\circ} F.$ ), or near  $165^{\circ} C.$  ( $329^{\circ} F.$ ); the latter variety gives with potassium hydroxide a compound crystallizing in needles.

**PREPARATIONS.**—1. *Tinctura Benzoini Composita*, 8 p. c.

*Unoff. Prep.*: *Ointment* (salve), 50 p. c., with lard or olive oil.

**PROPERTIES.**—Stimulant, expectorant, diuretic, antiseptic, disinfectant. Acts locally and remotely like benzoin, copaiba, balsams of Tolu and Peru. Styracin is antiseptic, and should be dissolved in 6–12 parts of oil or water to render it non-irritating as a dressing.

**USES.**—Chronic bronchitis and catarrhs of genito-urinary passages, gonorrhœa, gleet, amenorrhœa, leucorrhœa, phthisis, asthma. Externally in ointment as a detergent for indolent ulcers, frostbite, as a parasiticide for scabies, phthiriasis (pediculi), etc.

*Allied Products:*

1. *Styrax Calamita*.—Resinous exudation from *Styrax officinalis*, in agglutinated tears resembling benzoin, wrapped in leaves; a factitious variety consists of the ground, exhausted bark or sawdust mixed with liquid storax, formed into reddish-brown cylindrical cakes, brittle, friable, soft and unctuous to the touch; contains many crystals of styracin, and has storax odor.

2. *Sweet Gum (Liquidambar Styraciflua)*.—United States. The balsam exudes spontaneously in hot climates and warm weather, or from incisions made in the trunk; it is a yellowish-brown thick liquid, solidifying on exposure, but softening by heat of the hand, odor balsamic, storax-like; taste aromatic, pungent, soluble in alcohol, ether, chloroform; contains hydrocarbon 3.5 p. c. (almost identical with styrol); cinnamic acid 5.5 p. c., styracin, storesin. Stimulant, expectorant, diuretic. Dose, gr. 5–30 (.3–2 Gm.); in emulsion; externally in ointment, cerate. Used mainly as an agreeable flavor and in making chewing gum.

3. *Hew'chera americana'na, Alum Root*.—Saxifragaceæ. The rhizome, official 1820–1880; United States. Plant viscid, pubescent, .6–1.3 M. ( $2\frac{1}{4}$ °) high; leaves 5–7.5 Cm. ( $2\frac{1}{2}$ –3') wide, crenate; flowers purplish-white; root 15 Cm. (6') long, 12 Mm. ( $\frac{1}{2}$ ') thick, several-headed, many thin radicles, brownish-purple; bark thin, inodorous, astringent,

bitter; contains tannin 18–20 p. c., starch 5–16 p. c. Used as astringent, tonic, in diarrhœa, menorrhagia, aphthæ, ulcers, hemorrhoids. Dose, gr. 15–30 (1–2 Gm.), in decoction.

### 34. ROSACEÆ. Rose Family.

**Ro-za'se-e.** L. *Ros-a* + *aceæ*, fem. pl. *rosace-us*, rose-like, fr. *rosa*, a rose. Trees, shrubs, or herbs. Distinguished by astringency, succulent edible fruits, prickles and warts on woody surfaces; flowers regular, 5's; stamens inserted on calyx-tube, perigynous; calyx 4–5-lobed—when 5 the odd lobe posterior; anthers 2-celled; pistil 1—many, usually distinct; fruit often edible; seed exalbuminous. The yellow and white flowers resemble Ranunculacæ, here, however, the stamens and pistils are inserted on the torus, but in Rosacæ on the calyx; temperate climates; astringent, tonic, anthelmintic; fruit edible.

Genera: 1. **Rubus**. 2. **Rosa**. 3. **Quillaja**. 4. **Hagenia**.

#### RUBUS. RUBUS.

**Rubus** { *villosus*, Aiton,  
*nigrobaccus*, Bailey, } The dried bark of the rhizome.  
*cuneifolius*, Pursh.

*Habitat.* N. America, in fields, thickets, etc.

*Syn.* Blackberry: 1. European High-bush Blackberry, Cloud or Dewberry, Fingerberry. 2. N. American or Bramble High-bush Blackberry. 3. Sand Blackberry, Knee-high Blackberry; Fr. *Ecorce de Ronce noir*, *Ronce Sauvage*; Ger. *Brombeerrinde*.

**Ru'bus.** L. bramble fr. *rubere*, to be red, fr. Celtic *rub*, red—*i. e.*, color of the fruit.

**Vil-lo'sus.** L. hairy, shaggy, villous—*i. e.*, branches, petioles, and underside of leaves hairy.

**Ni-gro-bao'cus**, L. fr. *niger*, black, : *bacca*, berry—*i. e.*, the plant's fruit.

**Cu-ne-i-fo'li-us**, L. fr. *cuneus*, a wedge, + *folium*, a leaf—*i. e.*, shape of the leaves. *Blackberry*—*i. e.*, color of the fruit. *Dewberry*—*i. e.*, glaucous bloom on the fruit.

**PLANTS.**—All three are pubescent perennials having the angular, woody stems armed with stout, recurved prickles, leaflets 3–5, ovate, obovate, cuneate, petiolate, serrate, rough above, pubescent beneath,

FIG. 158.



*Rubus villosus*: transverse section of bark, magnified 15 diam.

2.5–10 Cm. (1–4') long; flowers white, 2.5 Cm. (1') broad, racemes; fruit July–Sept., of about 20 carpels, 12–25 Mm. ( $\frac{1}{2}$ –1') long, black, pulpy, delicious. **BARK OF THE RHIZOME**, in elongated, tough, flexible

## ROSACEÆ.

quills, 3–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') broad, or in similar bands, the bark 1–2 Mm. ( $\frac{1}{32}$ – $\frac{1}{12}$ ') thick, deep red-brown or dark gray-brown, occasionally blackish-brown, smoothish or somewhat scaly, inner surface yellow or pale brownish, strongly and coarsely long straight-striate; fracture tough-fibrous, readily splitting; inodorous; taste strongly astringent, bitterish. *Solvents*: boiling water; diluted alcohol. Dose, 3ss–1 (2–4 Gm.).

*Commercial*.—The European *R. villosus* is now thought not to occur in N. America, but what all along has been considered such is found to be *R. nigrobaccus* (.3–2 M.; 1–6°); this extends from N. England to Fla., Ark., and furnishes our cultivated blackberries. These two plants, along with *R. cuneifolius* (.3–1 M.; 1–3°), have long, horizontal rhizomes with thick bark, easily removable in quills by making a longitudinal incision along one side. The reason for discarding the low or running blackberries or dewberries (*R. canadensis* and *R. trivialis*), grew out of the root's vertical growth, as well as the thinness and fragility of their barks, rendering collection almost impossible.

*Constituents*.—Tannin 12–17.5 p. c. (heated gives pyrogallol, with alkalis gives neither gallic acid, protocatechuic acid, nor phloroglucol), gallic acid 0.4 p. c., villosin 0.8 p. c., ash 3 p. c.

*Villosin*.—One of the saponins, a bitter crystalline glucoside, soluble in alcohol, slightly in water, insoluble in ether, chloroform; yields villosic acid, which is soluble in alcohol, chloroform, ether; both villosin and villosic acid give with sulphuric acid deep blue or violet, with sulphuric and nitric acids yield blood-red, disappearing on addition of water.

*Preparations*.—1. *Fluidextractum Rubi*. Fluidextract of Rubus. (Syn., *Extractum Rubi Fluidum*, U. S. P. 1890, Fluidextract of Blackberry Bark; Fr. *Extrait liquide d'Écorce de Ronce*; Ger. *Flüssiges Brombeerrindenextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, Mx–60 (.6–4 Cc.).

*Prep.*: 1. *Syrupus Rubi*. Syrup of Rubus. (Syn., Fr. *Sirop d'Écorce de Ronce (noir)*; Ger. *Brombeerrindensirup*.)

*Manufacture*: Fluidextract of rubus 25 Cc., syrup 75. Dose, ʒj–4 (4–15 Cc.). Mainly for flavoring.

*Unoff. Preps.*: *Decoction*, 5 p. c. (water or milk), dose, ʒj–2 (30–60 Cc.). *Extract*, dose, gr. 3–10 (.2–.6 Gm.). *Wine*. *Aromatic Fluidextract*. *Aromatic Syrup*. *Brandy*.

*Properties*.—Same as tannin; astringent, tonic.

*Uses*.—Summer complaint, infantile diarrhœa.

FIG. 159.

*Rubus Idæus.*

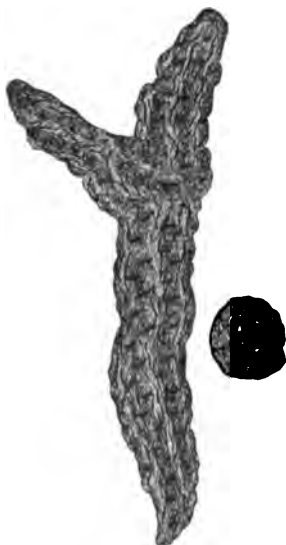
*Allied Plants:*

1. *Rubus Idæus*, *Raspberry*.—The fruit, official 1880–1900; Europe, N. Asia. Shrub 2 M. (6°) high, glaucous, spinose; leaves imparipinnate, 1–3 pairs, sessile, ovate, serrate, whitish, downy leaflets; flowers white, 5's. Fruit, deprived of conical receptacle (hollow base), hemispherical, red, finely hairy, composed of 20–30 coalesced, small drupes, each one crowned with withered style; juice red; odor agreeable; taste pleasant, slightly acidulous; contains volatile oil (trace), citric acid, malic acid, sugar 5 p. c., pectin, coloring-matter. The closely allied light red fruit, *R. strigosus*, and purplish-black fruit, *R. occidentalis*, may be substituted for this.

Refrigerant, mild laxative, dietetic; used for making syrup, and as an edible fruit.

2. *R. strigosus* (*L. strigilis*, set with stiff, straight bristles), *Wild Red Raspberry*, and *R. occidentalis*, *Black Raspberry*, *Thimble-berry*—both grow wild and are cultivated largely in N. America; *R. villosus* (*R. fruticosus*, Europe), *Blackberry*, *Dewberry*.—The fruit juice of these different species will yield, by fermentation, a grateful wine or beverage (becoming by distillation brandy), which is highly recommended, and much used by the laity, for bowel affections.

FIG. 160.



*Potentilla Tormentilla*: rhizome and transverse section.

3. *Ge'um riva'le*, *Purple or Water Avens*.—The rhizome, official 1820–1880. N. America. Perennial plant .3–.6 M. (1–2°) high, stem purple; leaves 3-foliate or 3-lobed; flowers purplish-orange. Rhizome 5–7.5 Cm. (2–3') long, 6 Mm. (¼') thick, tuberculate, wrinkled, brownish-red; bark thin, wood-wedges white, pith large; aromatic, astringent, bitter; contains volatile oil, tannin, bitter principle. Used as astringent, tonic, in diarrhœa, hemorrhage, leucorrhœa, phthisis, scrofula, rheumatism, intermittents, dyspepsia, menstrual derangements; in decoction, infusion, tincture. Dose, gr. 15–30 (1–2 Gm.).

4. *Potentilla Tormentilla*, *Tormentil*.—The rhizome, official 1820–1880. Europe. Plant resembles *P. canadensis*, *Cinquefoil*, perennial, 25–30 Cm. (10–12') high, green or reddish leaves, trifoliate; leaflets cuneate; flowers yellow; fruit achenes, reniform. Rhizome 5 Cm. (2') long, 12 Mm. (½') thick, tuberculate, brownish-red; bark thin, wood-wedges small, distant; pith large, inodorous, astringent; contains tannin 25 p. c., red coloring-matter (tormentil-red), kinovic acid, ellagic acid. Used as astringent, tonic like kino and catechu, for diarrhœa, dysentery, spongy gums (gargle), ulcers, gleet; in decoction, infusion. Dose, gr. 10–30 (.6–2 Gm.).

ROSACEÆ.

## ROSA GALLICA. RED ROSE.

*Rosa gallica*, Linné. } The dried petals, collected before expanding.

*Habitat.* W. Asia, S. Europe; cultivated (England, Holland, France, United States, etc.).

*Syn.* French Rose, Provins Rose; Br. *Rosæ Gallicæ Petala*, Red-rose Petals, Flores Rosarum Rubrarum; Fr. Rose de Provins, Roses rouges; Ger. Französische Rose, Essigrosen-(blätter), Zuckerrose.

*Rosa.* L. fr. Gr. *rhόδov*, Eng. rose, fr. Celtic *rhos*, red—*i. e.*, the prevailing color of the flowers.

*Galli-ca.* L. *gallicus*, of or pertaining to Gaul, now France—*i. e.*, country where once it flourished extensively = French rose.

**PLANT.**—Bushy shrub, .6–1 M. (2–3°) high, stems numerous, covered with prickles and a few sharp spines; leaves alternate, imparipinnate, 2 pairs opposite leaflets, these nearly sessile, ovate, rounded at base, acute at apex, serrate, stiff, keeled, rugose, with veins, pale, hairy below, leaf-serratures not edged with glands; flowers large, on long stalks, petals 5 in the wild state, more when cultivated, rich-crimson; fruit (hip) scarlet to orange-red, oblong, containing many 1-seeded achenes, calyx persistent. **PETALS**, usually in small cones, consisting of many imbricated, roundish retuse, deep purplish-red, yellow-clawed petals, characteristic, fine rose-like odor; bitterish, slightly acidulous, distinctly astringent taste. *Solvent*: boiling water. *Dose*, gr. 15–60 (1–4 Gm.).

**Commercial.**—This is what constitutes the red rose leaves of the drug store. The unopened corolla-buds are circumcised near the base with a sharp knife, leaving the stamens behind upon the calyx, or the entire blooms are cut off with knives or scissors, and dried carefully but rapidly by stove heat, sifted from stamens, etc., if necessary, and marketed; early collection makes them more astringent, while rapid drying preserves color as well as astringency, consequently slow desiccation impairs both properties. It is said that 1,000 flower buds yield 50 pounds (23 Kg.) fresh petals, which become 5 pounds (2.3 Kg.) when dried.

**ADULTERATIONS.**—Petals of various red roses.

**CONSTITUENTS.**—Volatile oil (trace), mucilage, sugar, tannin (quercitannic acid?), gallic acid, quercitrin (astringent and coloring).

**PREPARATIONS.**—1. *Confectio Rosæ*. Confection of Rose. (Syn., Br. *Confectio Rosæ Gallicæ*, *Conserva Rosarum*; Fr. *Conserve de Rose rouge*; Ger. *Rosen Conserve*.)

*Manufacture*: 8 p. c. Red rose 8 Gm., sugar 64, clarified honey 12, stronger rose water (heated) 16 Cc. *Dose*, 3ss–1 (2–4 Gm.).

*Prep.*: 1. *Pilulæ Aloes et Ferri*, q. s.

2. *Fluidextractum Rosæ*. Fluidextract of Rose. (Syn., *Extractum Rosæ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Rose rouge*; Ger. *Flüssiges Essigrosenextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with glycerin 10 Cc.,



diluted alcohol 90, finishing with latter alone q. s., evaporate to 100 Cc. Dose, ℥xv-60 (1-4 Cc.).

Preps.: 1. *Mel Rosæ*. Honey of Rose. (Syn., Mellitum Rosatum; Fr. Mellite de Roses rouges, Miel Rosat; Ger. Mel Rosatum, Rosenhonig.)

*Manufacture*: Fluidextract of rose 12 Cc., clarified honey q. s. 100 Gm. Dose, ʒj-2 (4-8 Cc.).

Prep.: 1. *Massa Hydrargyri*, 33 p. c.

2. *Syrupus Rosæ*. Syrup of Rose. (Syn., Br. Syrupus Rosæ Gallicæ; Fr. Sirop de Roses rouges; Ger. Rosensirup.)

*Manufacture*: Mix fluidextract of rose 12.5 Cc., diluted sulphuric acid 1, water 30; after 2 hours filter, dissolve sugar 75 Gm. in clear filtrate by agitation, add water q. s. 100 Cc., strain. Dose, ʒj-2 (4-8 Cc.).

3. *Pilulæ Aloes et Mastiches*,  $\frac{1}{2}$  gr. (.03 Gm.).

*Unoff. Preps.*: *Infusion*, 3-5 p. c. *Compound Infusion*, 1.5 p. c. (+ diluted sulphuric acid 1 p. c., sugar 4.5 p. c.), dose, ʒss-2 (15-60 Cc.). *Infusum Rosæ Acidum* (Br.), 2.5 p. c. + diluted sulphuric acid 1.25 p. c., water q. s.

**PROPERTIES.**—Similar to tannin; tonic, mild astringent, carminative.

**USES.**—Uterine and other hemorrhages, aphthæ, ulcers of mouth, ears, anus, inflamed eyes, chapped hands, burns, flavoring vehicle, perfumery.

FIG. 161.



*Rosa canina*.

*Allied Plants*:

1. *Rosa centifolia*, *Pale Rose*.—The petals, collected after expanding, official 1820-1900; W. Asia. Plant erect, 1-2 M. (3-6°) high, similar to but larger than *Rosa gallica*; stems covered with prickles, larger ones hooked; leaves imparipinnate, 2 pairs of opposite leaflets; flowers large, double, calyx persistent; fruit (hip) scarlet to orange-red, oblong, containing many 1-seeded achenes. Petals numerous, roundish-obovate, retuse, or obcordate, pink, fragrant, sweetish, slightly bitter, faintly astringent; contain volatile oil, mucilage, sugar, tannin, malates, phosphates (quercitrin?). This, although often mistaken for the Damask rose, is no doubt the most anciently cultivated variety of *R. gallica*, and exists in many hybrid forms which are employed indiscriminately. Used as mild carminative, for distilling the oil and rose water—the latter being of fine flavor, and more used in this country, mainly owing to cheapness, than that imported. Dose, gr. 15-60 (1-4 Gm.).

2. *R. canina*, *Dog Rose*.—United States. Leaflets 5-7, ovate, serrate, flowers pink, white, also *R. blan'da* and *R. nit'ida*.

## ROSACEÆ.

## ROSA DAMASCUS. DAMASCUS ROSE.

*Oleum Rosæ.* Oil of Rose, *official.*

*Rosa damascena*, *Mueller.* } A volatile oil, distilled from the fresh flowers.

*Habitat.* India, N. Africa, S. France; cultivated in Turkey (Europe), Bulgaria.

*Syn.* Damask Rose, *Oleum Rosarum*, Otto (Attar) of Rose; Fr. Huile volatile (Essence) de Rose; Ger. Rosenöl.

*Da-mas-ce'na.* L. *damascenus*, of or pertaining to Damascus; Gr. *Δαμασκός*. Heb. *Damaseq*, capital of Syria, around which this rose once flourished.

**PLANT.**—Resembles very closely the two preceding species, 2–2.5 M. (6–8°) high, believed to be simply a cultivated form of *R. gallica*. It is grown largely in hedge-like rows on the southern slope of the Balkan Mountains (the principal town, Kizanlik, of Roumelia province alone furnishing about 4,000 pounds (1,818 Kg.) of oil annually), Egypt, Persia, Cashmere (India).

**CONSTITUENTS.**—Volatile oil 0.05 p. c., fat, resin, malic acid, tartaric acid, and tannic acid.

***Oleum Rosæ.* Oil of Rose.**—Obtained 'by collecting the roses, usually with calyx, in April–May, then, each day before sunrise, putting 30 pounds (13 Kg.) together with 8 gallons (30 L.) of water into a 20-gallon (80 L.) tinned-copper still, and distilling same for 2 hours. The distillate is distilled again, the first one-sixth being set aside several days for the oil to separate, when it is skimmed from the surface of the water with a very small tin funnel having fine orifice and long handle. The remainder, together with water of subsidence and expression, is used for rose water, and for the menstruum on fresh roses instead of pure water; 3,000 pounds (1,363 Kg.) of petals (5,000–6,000 pounds (2,272–2,726 Kg.) of flowers) yield 1 pound (.5 Kg.) of oil. It is a pale yellowish transparent liquid, strong, fragrant odor of rose, mild sweetish taste, sp. gr. 0.860, slightly soluble in alcohol; congeals at 18–22° C. (64–72° F.); should have saponification value of 10–17 (palmarosa oil 30–50, geranium oils 45–100, hence can readily distinguish); consists of two portions, one liquid, the other solid; the liquid portion upon which the fragrance depends is composed of 2 alcohols: 1, *rhodinol* or *geraniol*,  $C_{10}H_{18}O$ , a very fragrant liquid forming 75 p. c. of the oil, readily soluble in alcohol, yielding ethers with acetic and benzoic anhydrides, and when oxidized with potassium dichromate and sulphuric acid converted into the aldehyde rhodinal or citral; 2, *citronellol*,  $C_{10}H_{20}O$ , in very small quantity; the solid portion is a stearopten, 12–14 p. c., concrete, crystalline, inodorous, iridescent, consisting of a mixture of hydrocarbons ( $C_nH_{2n}$ ), one being  $C_{20}H_{42}$ , which melts at 36° C. (97° F.), and requires 100 parts of alcohol for solution.

**Tests:** 1. Add 70 p. c. alcohol, get precipitation of paraffin hydrocarbons, but forms clear acid solution with its other constituents.

**Assay:** Weigh 2 Cc. oil, transfer with aid of little alcohol to 100 Cc. flask, add 20 Cc.  $\frac{N}{2}$  alcoholic potassium hydroxide V. S.; connect flask with reflux condenser, boil 30 minutes, cool, add 50 Cc. distilled

water + few drops phenolphthalein T. S., titrate with  $\frac{N}{2}$  sulphuric acid V. S.; subtract number Cc. of acid V. S. required from 20, multiply difference by 27.87, divide by weight of oil = saponification value. Should be kept cool, dark, in well-stoppered, amber-colored vials, and before dispensing should be liquefied by warming and shaking, as the odor resides exclusively in the liquid portion of the oil.

ADULTERATIONS.—Spermaceti, paraffin, which crystallize in an opaque crust, oil of santal, oil of guaiac wood, fixed oils, volatile oils (palmarosa, rose geranium, etc.—those having one or more constituents (geraniol) in common with oil of rose). In Constantinople the adulteration is carried on extensively with these named articles, and with the oil of true geranium (ginger grass, Rosé, Roshé or Rusa oil); this latter does not solidify by cold, consequently when added to attar of rose lowers its congealing-point, also renders it acid; this again inclines the dealers to use spermaceti or to seek inferior attar (that made in the mountains, deficient in odor, but having excess of stearopten), so that the higher grades of oil will stand all the greater dilution with the ginger grass oil without crystallizing.

PREPARATIONS.—1. *Aqua Rosæ Fortior*. Stronger Rose Water. (Syn., Triple Rose Water, Aqua Rosæ (U. S. P. 1880); Ger. Stärkeres Rosenwasser.)

*Manufacture*: Water saturated with volatile oil of rose petals, obtained by distillation. It is colorless, clear, not mucilaginous, odor of roses, free from empyreuma, and should give no reaction with hydrogen sulphide T. S. or ammonium sulphide T. S. (abs. of metallic impurities). Should be kept dark, in bottles loosely stoppered with a pledget of purified cotton. Dose, ʒij–8 (8–30 Cc.).

Preps.: 1. *Aqua Rosæ*. Rose Water. (Syn., Aqua Rosarum; Fr. Eau distillée de Rose; Ger. Rosenwasser.)

*Manufacture*: Stronger rose water, distilled water, each equal quantities; to be mixed immediately before using. Dose, ʒij–8 (8–30 Cc.).

Prep.: 1. *Mistura Ferri Composita*, 89 p. c.

2. *Unguentum Aquæ Rosæ*. Ointment of Rose Water. (Syn., Cold Cream; Fr. Crème froide; Ger. Unguentum leniens (Emolliens).)

*Manufacture*: Melt spermaceti 12.5 Gm., white wax 12, add expressed oil of almond 56, stir, heat until uniform, add gradually stronger rose water 19, previously warmed and having dissolved in it sodium borate .5, stir until it congeals; when to be used with metallic salts, sodium borate should be omitted.

3. *Confectio Rosæ*, 16 p. c.

PROPERTIES AND USES.—Mild astringent, carminative, chiefly in perfumery and for flavoring. Ointment, a soothing, emollient application to the skin, chapped hands and lips, abrasions, ulcers, frost-bite, etc.

ROSACEÆ.

## QUILLAJA. QUILLAJA.

**Quillaja**  
**Saponaria, Molina.** } The dried bark, deprived of periderm.

*Habitat.* Chile (cultivated in N. Hindustan).

*Syn.* Quillaia, Soap Bark, Panama, China or Murillo Bark, Cullay; Br. Quillaie; Cortex, Quillaia Bark; Fr. Écorce de Quillaya; Ger. Cortex Quillaie, Seifenrinde.

**Quil-la'ja.** L. fr. Chilean *quillai*, *quillay*, *cullay*, *quillean*, to wash, good in washing—i. e., from its soap-like properties.

**Sap-o-na'-ri-a.** L. fr. *saponarius*, soapy, *sapo*, soap—i. e., its mucilaginous juice forms a lather with water.

**PLANT.**—Tree 15–18 M. (50–60°) high; leaves oval, evergreen, leathery, entire or slightly dentate; flowers white, monœcious, axillary, pedunculate, apetalous, in umbels of 4; fruit capsule with persistent calyx of 5 segments; many-seeded. **BARK**, in flat pieces of variable length, 3–8 Mm. ( $\frac{1}{8}$ – $\frac{1}{3}$ ') thick, or small chips, brownish-white, often

FIG. 162.



Quillaja Saponaria.

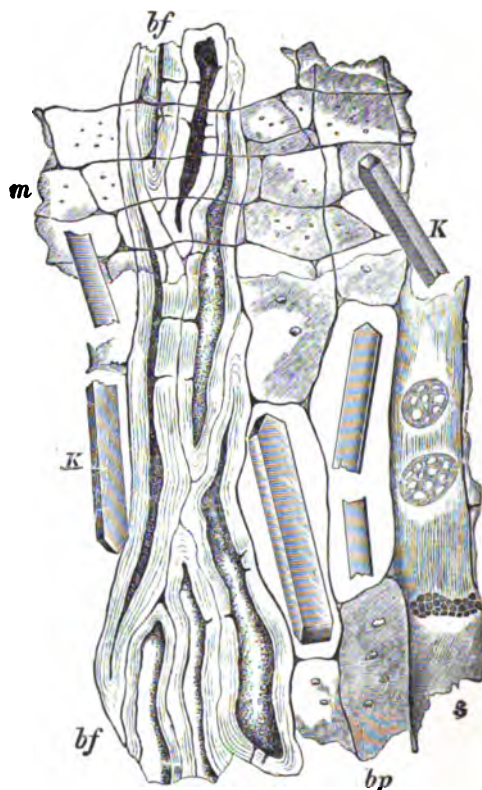
with patches of cork, otherwise nearly smooth; inner surface yellowish-white, nearly smooth, with occasional circular depressions, conical projections or transverse channels, fracture uneven, strongly fibrous, the lamina oblique to each other; odor slight; taste acrid; powder strongly sternutatory, containing calcium oxalate in monoclinic pyramids and prisms; infusion foamy like soap water. *Solvents*: hot water; hot alcohol; alcohol. Dose, gr. 15–30 (1–2 Gm.).

**CONSTITUENTS.**—Saponin,  $C_{32}H_{54}O_{18}$ , 9 p. c., starch, gum, saccharose, calcium oxalate and sulphate.

**Saponin.**—A glucoside obtained by exhausting with hot alcohol,

from which it separates upon cooling ; by this process a small amount (with resinous and oily matter) still remains in the cold tincture, which evaporated and shaken with water emulsifies. Pure saponin is a white, amorphous, pungent powder, inodorous, sweetish, causes sneezing, and consists of 2 glucosides : (a) *quillajic acid*  $C_{19}H_{30}O_{10}$ , soluble in alcohol, precipitated by lead acetates ; (b) *quillaja-sapotoxin*,  $C_{17}H_{26}O_{10}$ , highly poisonous, neutral, nearly insoluble in alcohol, not precipitated by normal lead acetate.

FIG. 163.



*Quillaja Saponaria*, longitudinal section : *bf*, bast fibre ; *bp*, sieve-parenchyma ; *s*, sieve-tube ; *m*, medullary ray ; *K*, crystal.

PREPARATIONS. 1. *Fluidextractum Quillajæ*. Fluidextract of Quillaja. (Syn., Fluidextract of Soap-bark ; Fr. Extrait liquide d'Écorce de Quillaja ; Ger. Flüssiges Seifenrindenextrakt.)

*Manufacture* : Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose,  $\text{Mv}$ -15 (.3-1 Cc.).

2. *Tinctura Quillajæ*. Tincture of Quillaja. (Syn., Teinture d'Écorce de Quillaja ; Ger. Seifenrindentinktur.)

*Manufacture* : 20 p. c. Boil 15 minutes in covered vessel 20 Gm. with water 80 Cc., strain, wash residue on strainer with boiling water

**ROSACEÆ.**

20, strain, evaporate to 60, cool, add alcohol 35, set aside 12 hours, decant, filter, add water q. s. 100 Cc. Dose, ʒss-1 (2-4 Cc.).

*Unoff. Preps.* : Infusion, 5 p. c., dose ʒij-8 (8-30 Cc.). Syrup, 15 p. c., dose ʒj-3 (4-12 Cc.). *Aqueous Extract.* These may be taken internally, but are used mostly as emulsifying agents, and in washing silks, cloth, etc., for which soap sometimes is unsuited.

**PROPERTIES.**—Stimulant, diuretic, expectorant, irritant, detergent. These all due to saponin—found also in senega and some other plants; it is a violent irritant to respiratory passages, local anæsthetic, antipyretic, paralyzant to heart and respiration, poison to voluntary muscles.

**Uses.**—Like senega, useful in bronchitis, coryza, dropsy, rhinitis (snuff); syrup employed as a substitute for syrup of senega; dry extract (quillain) mostly in solution for emulsifying fixed oils (castor, cod-liver, etc.); the infusion for eruptions, sores, fetor of feet, armpits, etc.; to renew growth of hair in alopecia, in hair tonics, washes, etc.

**Allied Plants:**

1. *Spiræa tomento'sa*, Hardhack.—The root, official 1820-1880.

FIG. 164.



*Porteranthus stipulatus.*

FIG. 165.



*Porteranthus trifoliatus*: rootlets, natural size.

N. America; shrub, .6-1 M. (2-3°) high, stem ferruginous, tomentous, leaves dark green, but rusty-white beneath; flowers purple; fruit 1-seeded pod; root consists of brown, bitter, astringent bark, and hard, white, tasteless wood; contains tannin, bitter principle, volatile oil. Used as astringent, tonic in diarrhoea, cholera infantum, hemorrhages, gonorrhœa, ulcers, etc.; in infusion, decoction, extract. Dose, ʒss-1 (2-4 Gm.).

2. *Porteranthus stipulatus* (*Gille'nia stipulacea*), Indian Physic, and *P. trifoliatus* (*G. trifoliata*), American Ipecac.—The root, official 1820-1880. United States; shrubs .6-1 M. (2-3°) high, stems red-

dish-brown, leaves trifoliate; leaflets 5–10 Cm. (2–4') long, pubescent; flowers white, pink; root (rhizome) 12–25 Mm. ( $\frac{1}{2}$ –1'), thick, with thin bark and many fissured rootlets, 3–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') thick, bitter; contains gillenin, resin, tannin. Used as emetic (substitute for ipecac), purgative, tonic; in infusion, decoction, tincture. Was very popular with North American Indians. Dose, emetic, gr. 15–30 (1–2 Gm.); tonic, gr. 2–5 (.13–.3 Gm.).

## CUSO. KOUSSO.

**Hagenia**  
**abyssinica**, (Bruce) Gmelin. } Dried panicles of the pistillate flowers.

*Habitat.* Abyssinia, tablelands, mountainous districts, planted near towns, villages.  
*Syn.* Brayera, Cosso, Kooso, Cossou, Kusso; Fr. Couso, Kouso; Ger. Flores Koso, Kosoblüthen.

**Ha-ge'ni-a.** L. after Dr. K. G. Hagen, German botanist, died 1829.

**Ab-ys-sin'i-ca.** L. its habitat, Abyssinia. *Cus'so*, Abys. name of plant.

**PLANT.**—Handsome, ornamental tree, 6–12 M. (20–40°) high; leaves 25–30 Cm. (10–12') long, imparipinnate; leaflets 3–6 pairs, 7.5–10 Cm. (3–4') long, sessile, serrate; flowers Oct.–Nov., monœcious; staminate greenish-yellow, called when dry *Kouso-esels*. **PISTILLATE PANICLES**, in rolls or compressed bundles 25–40 Cm. (10–16') long, reddish-brown, each branch arising from axil of a sheathing bract, each flower with 2 rounded bracts at base, calyx-tube top-shaped, pubescent, bearing a circle of 5 purple-veined bracts resembling outer calyx, which are larger than the 5 usually shriveled, incurved oval calyx-lobes; 5 caducous petals, usually absent in drug; carpels 2; styles exserted, stigmas broad, hairy; odor slight, agreeable; taste bitter, acrid, nauseous; large stems should be rejected, often called *Red kouso*. *Solvents*: boiling water; alcohol. Dose, ʒij–6 (8–24 Gm.).

**Commercial.**—Cusso is gathered before the seeds are quite ripe, and suspended in the sun to dry; it is brought from Abyssinia, packed in boxes, reaching England, via Aden and Bombay. The fresher the drug and the greener the resin the more active.

**CONSTITUENTS.**—Kosin,  $C_{23}H_{30}O_7$  (resins), 6.25 p. c., Volatile oil, Tannin 24 p. c., ash 5 p. c. Latest investigations reveal: kosin, kosidin, protokosin (crystalline, inactive), and kosotoxin (amorphous, active constituent).

**Kosin, Koussin, Kussin, Brayerin** (*koussein*, *kussein*, amorphous).—Bitter, acrid resin along with tasteless resin. Obtained by heating cusso repeatedly with alcohol to which calcium hydroxide has been added, boil residue with water, mix liquids, filter, distil, treat residue with acetic acid to precipitate kosin in white, flocculent form, soon becoming denser and resin-like. When pure it is yellow, crystalline, bitter, acrid taste, odor of Russia leather, soluble in chloroform, ether, alcohol, sparingly in water, and as such is nearly inert and tasteless, hence to act properly it should be associated with the drug's other constituents. Dose, gr. 5–30 (.3–2 Gm.).

**ROSACEÆ.**

**Kosotoxin**,  $C_{52}H_{68}O_2$ .—Yellow, amorphous powder, soluble in alcohol, ether, insoluble in water; powerful muscle poison; claimed to be the active principle; with baryta water yields a yellow, crystalline inactive substance—possibly kosin.

**Volatile Oil**.—Obtained by distillation; has odor of the drug; by distillation with water get traces of valeric (valerianic) and acetic acids.

**PREPARATIONS**.—(Unoff.) *Fluidextract* (alcohol.) Dose, ʒij–6 (8–24 Cc.). *Infusion*, dose, ʒiv–8 (120–240 Cc.). *Compound Emulsion* = Infusion + castor oil, ether, sugar, anise oil. *Electuary*.

FIG. 166.



*Hagenia abyssinica*: A, branch of panicle; B, staminate flower; and C, pistillate flower, magnified 4 diam.

**PROPERTIES**.—Anthelmintic, tænifuge.

**USES**.—From time immemorial used in Abyssinia for both kinds of worms, especially tapeworms. Its action is so severe as often in large doses to produce miscarriage, colic, vomiting, purging, sometimes death, but with care becomes one of the very best remedies, provided it be fresh (as the resin soon undergoes change and deterioration by age). One should fast the day previous to taking this medicine—preceding it, the night before, with a cathartic (castor oil, calomel, etc.), thus disarming, as far as possible, the parasite of its nidus. Should the drug not act within 6–8 hours, another cathartic should be administered to remove



it, as well as possibly the parasite. As a rule, the worms are discharged dead within 24 hours.

The *Oleoresin of Male Fern* is more agreeable and reliable than cusso or any of its preparations, in doses of 3ss–1 (2–4 Cc.).

### 35. DRUPACEÆ. Plum Family.

**Dru-pa'se-e.** L. *Drup-a* + *aceæ*, fr. Gr. *δρῦζ*, tree, + *πέπτειν*, ripen, *δρουπεής*, ripened on the tree—i. e., the stone fruit. Trees, shrubs. Distinguished by bark and seeds containing hydrocyanic acid (poisonous), the former exuding gum, bitter; calyx 5-lobed, campanulate; petals 5, on calyx, stamens many; pistil 1, ovary 1-celled, 2-ovuled; fruit drupe; temperate climates; tonic, astringent, sedative, nutritious, lumber.

Genus: 1. **Prunus.**

#### PRUNUS VIRGINIANA. WILD CHERRY.

**Prunus serotina**, Ehrhart. } The bark collected in autumn, care-  
(**Prunus virginiana**, Miller.) } fully dried and preserved.

*Habitat.* N. America (Can. to Fla., to Minn., Neb., Kan., La., to Texas.), in woods.

*Syn.* Black, Choke, Cabinet, Rum, Whisk or Wild Black Cherry, Black Choke; Br. *Pruni Virginianæ* Cortex, Virginian Prune Bark; Fr. *Écorce de Cérissier de Virginie*; Ger. *Wildkirschenrinde*.

**Pru'nus.** L. fr. Gr. *πρῖνη*, a plum tree; *prunum*, a plum—i. e., classic name.

**Se-rot'i-na.** L. *serotinus*, fr. *serus*, late—i. e., the latest to bloom and fruit of the genus.

**Vir-gin-i-a'na.** L. of, or belonging to Virginia—Virginian.

**PLANT.**—Large tree 9–24 M. (30–80°) high; trunk regular, straight, with blackish, rugged outside bark, that of young branches

FIG. 167.



*Prunus serotina.*

smooth, red or purplish; leaves 5–12.5 Cm. (2–5') long, oval, petiolate, serrate, teeth glandular, glabrous, shining, bright green, with 2 small glands on the margin at the base; flowers May–June, appearing after the leaves, small, white, racemes; fruit August, drupe, size of a pea, purplish-black, pulpy—bitter cherries; seed subglobular, bitter-almond flavor, containing bland yellowish-green fixed oil 25 p. c. BARK, usually in transversely curved pieces 3–7 Cm. (1½–3') long, 12–25 Mm. (½–1') wide, 0.5–4 Mm. (1⁄50–1⁄6') thick, pale green, greenish-brown, smooth, with numerous transverse lenticels, inner surface light brown, reticulately striate or fissured, fracture short,

brittle, granular, consisting alone of inner layer (derm), the periderm being removed, also corky layer from old wood-bark, which then is uneven and nut-brown externally; macerated in water gives bitter-

**DRUPACEÆ.**

almond odor ; taste astringent, aromatic, agreeably bitter ; powdered bark has deep fawn color ; bark of very large and very small branches should be rejected. *Solvents* : hot or cold water. Dose, 3ss–1 (2–4 Gm.).

**ADULTERATIONS.**—Unrossed bark, that of old stems, also that of choke berry ; this latter closely resembles the official, but as a rule is either thinner or thicker, and breaks with a very tough fracture like slippery elm.

**Commercial.**—The Latin official name, from its long usage, has been retained, although misleading ; *Prunus virginiana* was given early by Linnæus to Choke Cherry, a shrub 2.5–3 M. (8–10°) high, having more sharply toothed leaves, shorter racemes, and fruit astringent, dark red, crimson, size of wild cherry. It has received various names at different times, as *Prunus ru'bra*, *P. obova'ta*, *P. virginiana*, *P. serotina*, *Cerasus serotina*, *C. virginiana*.

The true official *Prunus serotina* grows in fertile soil in fields, woods, along fences, seldom in clusters. Wood is valuable for furniture, being fine grained, red color, and easily polished. Bark after collection is (rossed) deprived of outside layer (periderm or ross) and then

FIG. 168.

*Prunus Laurocerasus.*

dried ; while that from all portions of the tree is used, that from the root is strongest, yet it all soon deteriorates, consequently only the fresh-dried should be employed ; the average bark collected in April yields most starch, but least tannin, and hydrocyanic acid = 0.0478 p. c. ; in June = 0.0956 p. c. ; in Oct. = 0.1436 p. c. or  $\frac{1}{4}$  gr. (.009 Gm.) from 100 gr. (6.5 Gm.) bark, which equals 7–8 M (.5 Cc.) of official acid ; young bark may yield of acid 0.183–0.250 p. c., old bark 0.159–0.335 p. c.

**CONSTITUENTS.**—Amygdalin, Emulsin, Bitter principle, tannin 2–4.5 p. c., gallic acid, resin, starch, (volatile oil, hydrocyanic acid).

**Amygdalin.**—Glucoside, obtained by the action of alcohol; it is bitter, non-crystalline, and not precipitated by ether, hence in this differs from that in *amygdala amara*.

**Emulsin.**—Ferment, extracted by water; white powder when pure, and by its action on amygdalin, in the presence of water, develops hydrocyanic acid and the volatile oil of bitter-almond, neither of which, as such, existed previously in the bark. These two are obtained also by distilling the seeds with water, when they come over more or less mixed. The poisonous property of the oil depends largely upon the amount of acid present, so that freed from this latter it becomes a bland, colorless liquid resembling that from bitter-almond. Some think the ferment to be neither emulsin nor synaptase, but a closely analogous compound.

**Bitter Principle.**—Obtained by mixing soft aqueous extract with alcohol, shaking with milk of lime, evaporating filtrate, boiling residue with alcohol, evaporating, getting brown, bitter, gelatinous mass, which is insoluble in ether, soluble in alcohol, brownish-red with sulphuric acid.

**PREPARATIONS.**—1. *Fluidextractum Pruni Virginianæ*. Fluid-extract of Wild Cherry. (Syn., *Extractum Pruni Virginianæ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide d'Écorce de Cerisier de Virginie*; Ger. *Flüssiges Wildkirschenrindenextrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with glycerin 20 Cc., water 20, finishing with alcohol 20 p. c., q. s. 100 Cc. Dose, 3ss–1 (2–4 Cc.).

2. *Infusum Pruni Virginianæ*. Infusion of Wild Cherry. (Syn., Fr. *Tissane d'Écorce de Cerisier sauvage*; Ger. *Wildkirschen-Thee*.)

**Manufacture:** 4 p. c. Macerate 1 hour 4 Gm. in water 60 Cc., now percolate into receiving bottle containing glycerin 5 Gm., with water q. s. 100 Cc. Dose, 3ss–2 (15–60 Cc.).

3. *Syrupus Pruni Virginianæ*. Syrup of Wild Cherry. (Syn., Br. *Syrup of Virginian Prune*; Fr. *Sirop d'Écorce de Cerisier*; Ger. *Wildkirschenrindensirup*.)

**Manufacture:** 15 p. c. Moisten 15 Gm. with water q. s., macerate 24 hours, percolate with water into a graduated receiving bottle containing glycerin 15 Cc. (shaking the percolate occasionally with the glycerin), until liquid measures 45 Cc., in this dissolve sugar 70 Gm., by agitation, strain, add water q. s. 100 Cc. Dose, 3j–4 (4–15 Cc.); mainly for flavoring.

**Unoff. Prep.:** *Tinctura Pruni Virginianæ* (Br.), 20 p. c. + alcohol 62.5 p. c., dose, 3ss–1 (2–4 Cc.).

**PROPERTIES.**—Sedative, pectoral, aromatic bitter tonic, astringent; increases appetite, digestion. Volatile oil—local stimulant on alimentary canal like *cascarilla*, *serpentaria*, etc. Hydrocyanic acid—sedative, nervine, large doses decrease heart action. Tannin is astringent.

## DRUPACEÆ.

USES.—Consumption, cough, bronchitis, scrofula, heart palpitation, stomach atony, dyspepsia, hectic fever. Cold infusion in ophthalmia. It is much inferior to cinchona in intermittents.

*Allied Plant:*

1. *Prunus* (*Cer'asus*) *Laurocer'asus*, *Cherry Laurel*.—W. Asia. Ornamental shrub 3–6 M. (9–20°) high; leaves 15 Cm. (6') long, oblong, serrate, bitter-almond odor; aromatic, bitter taste; contains laurocerasin (almost identical with amygdalin), ferment, bitter principle, tannin, sugar. Produces hydrocyanic acid and volatile oil, consisting of benzaldehyde,  $C_7H_6O$ . Sedative, narcotic; used for making cherry-laurel water (*Aqua Laurocerasi* (Br.))—distil 400 Cc. from leaves 320 Gm. + water 1,000 Cc. Dose. 3ss–2; 2–8 Cc.).

## PRUNUM. PRUNE.

*Prunus domestica*, Linné. } The partly dried ripe fruit.

*Habitat.* W. Asia, Asia Minor, Syria; cultivated in S. France, California, etc.

*Syn.* Damson or Horse Plum, Damson, Prunes, French Plum, Saint Catherine Prunes; Fr. Pruneau noir, Pruneaux; Ger. Pflaume(n), Zwetsche(n).

*Prunum.* L. a plum, from Gr. *πρῶνον*, *πρῶνος*, plum-tree—i. e., classic name.

*Do-mes'ti-ca.* L. *domesticus*, domestic, common—i. e., the familiar or common kind.

**PLANT.**—Small tree 4.5–6 M. (15–20°) high; leaves 5 Cm. (2') long, dentate, ovate, pubescent beneath; flowers April, 18 Mm. ( $\frac{3}{4}$ ') wide, whitish. **FRUIT**, a drupe, 2.5–4 Cm. (1–1 $\frac{3}{8}$ ') long, oblong, ellipsoidal, somewhat compressed, brownish-black, shriveled; sarcocarp sweet, acidulous; putamen hard, smooth or irregular ridged; seed almond-shaped, but smaller, bitter-almond taste. Dose, *ad libitum*.

**Commercial.**—There are several varieties of dried plums or prunes; *St. Catherine* and *Greengage* are the finer, being used as dessert fruits; those for medicine are from *P. domestica* var. *Juliana*, called in France *Prune de St. Julian*. The most and best come from Bordeaux, S. France; these ripen in the autumn and, after being pulled, are exposed, on alternate days, to the sun and stoves until dried. Germany furnishes an inferior variety which is used only in the absence of the French.

**CONSTITUENTS.**—SARCOCARP: Sugar 12–25 p. c., pectin, albumin, malic acid, salts. **SEEDS:** Fixed oil, amygdalin, emulsin.

**PREPARATIONS.**—1. *Confectio Sennæ*, 7 p. c.

*Unoff. Preps.: Infusion. Decoction.*

**PROPERTIES.**—SARCOCARP: Nutritious, laxative, demulcent.

**USES.**—Constipation. Added to laxative confections to improve flavor and aid purgation; in excessive quantities they gripe, cause flatulency and indigestion due to indigestibility of the skins; often they are stewed with sugar or may be eaten alone; inferior kinds may be used in pies, tarts, etc. May ferment to make brandy, which contains about 40 p. c. alcohol.

## AMYGDALA AMARA. BITTER ALMOND.

**Prunus**  
**Amygdalus**, var. **amara**, *De Candolle*. } The ripe seed.

*Habitat.* W. Asia, Persia, Syria, Barbary, Morocco; (naturalized in Mediterranean Basin); cultivated in Europe; unsuccessfully in the United States.

*Syn.* Greek Nuts; Fr. Amandes amères; Ger. Amygdalæ Amaræ, Bittere Mandeln.

**A-myg'da-lus.** L. fr. Gr. ἀμύγδαλον, to lacerate—i. e., its fissured shell.

**A-ma'ra.** L. *amarus*, bitter—i. e., the fruit.

**PLANT.**—Small tree, 5–6 M. (15–20°) high, bark purplish; leaves bright green; flowers pale pink or white; fruit drupe, ovate, 5 Cm. (2') long, 2.5 Cm. (1') broad, sarcocarp green, leathery, splitting into two halves when ripe, and falling from the stone. This remaining stone is the commercial almond, and may be sold as such or may be bleached by SO<sub>2</sub>, thereby also killing any attached insects. By cracking off hard shell the kernel, or, properly, the seed, is left, which, when

FIG. 169.



*Prunus Amygdalus*: 1, flowering twig; 2, twig, with fruit; 3, fruit hull cracked off; 4, seed deprived of hull; 5, vertical section of flower; 6, longitudinal section of seed.

deprived of papery endocarp by hot water, constitutes the more desirable blanched almond. **SEED** (almond), 2.5 Cm. (1') long, oblong-lanceolate, flattish; testa cinnamon-brown, thin, finely downy, marked by about 16 lines radiating from broad scar at blunt end; embryo straight, white, oily, with 2 plano-convex cotyledons; taste bitter, oleaginous; triturated with water yields milk-white emulsion, emitting odor of hydrocyanic acid.

**ADULTERATIONS.**—**SEED**: Sweet-almonds chiefly (Valencia) and peach seeds—both cheaper; the bitter differs from the sweet in flavor, odor with water, containing amygdalin, being shorter, broader, thinner, less plump and darker, and from peach seeds by being much larger. **OIL**: Alcohol, oil of turpentine, nitrobenzene, impure benzaldehyde from toluene (chlorine), etc.

**DRUPACEÆ.**

There are several varieties of these (*French, Sicily, Barbary*, in order of value), being exported chiefly from Mogador, in Morocco.

**CONSTITUENTS.**—Fixed oil 46 p. c., Amygdalin 1–3 p. c., Emulsin, (mucilage 3 p. c., proteids (myosin, vitellin, conglutin) 24–30 p. c., precipitated by acetic acid, sugar 6 p. c., ash 3–5 p. c. = K, Ca, Mg—phosphates); yield volatile oil 1 p. c.; hydrocyanic acid 0.25 p. c.

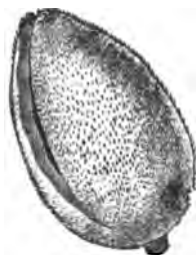
**Amygdalin**,  $C_{20}H_{27}NO_{11}$ .—A crystalline glucoside, obtained from expressed cake (deprived of fixed oil) by boiling in alcohol, distilling to syrup, adding water + yeast, and then allowing fermentation; after this, filter, evaporate to syrup, add alcohol to precipitate amygdalin and gum, from which boiling alcohol takes up the former, depositing it upon cooling.

**Emulsin** (*synaptase*).—Coagulated by heat, precipitated by alcohol, but not by acetic acid, is a ferment which, in the presence of water, acts upon amygdalin, forming glucose,  $C_6H_{12}O_6$ , hydrocyanic acid, HCN (1 part being formed from 17 of amygdalin), and benzaldehyde,  $C_6H_5O$  = oil of bitter almond 1–4 p. c.;  $C_{20}H_{27}NO_{11} + 2H_2O = 2(C_6H_{12}O_6) + HCN + C_7H_6O$ .

**Oleum Amygdalæ Amaræ.** Oil of Bitter Almond, *official*.—(Syn., Oleum Amygdalarum (Amararum) Æthereum; Fr. Essence d'Amandes amères; Ger. Bittermandelöl.) This volatile oil is obtained from bitter-almond and other seeds containing amygdalin; like volatile oil of mustard and oil of wintergreen it does not preëxist in the seeds, but results from macerating the expressed cake of bitter almonds with water, when reaction takes place between amygdalin and emulsin, then distilling; seeds of the peach (*P. Persica*), and apricot (*P. armeni'aca*) yield much of the commercial oil, which may also be prepared synthetically from toluene (see benzaldehydum, page 282). It is a clear, colorless or yellowish, volatile, strongly refractive liquid, peculiar aromatic odor, bitter, burning taste, sp. gr. 1.050, soluble in alcohol, ether, 300 parts water, equal volume 70 p. c. alcohol; contains at least 85 p. c. benzaldehyde,  $C_6H_5CHO$ , and 2–4 p. c. hydrocyanic acid (sometimes as much as 8–10 p. c.); when freed from this latter it is less poisonous, but even then has a marked physiological action on the nervous system; neutral when fresh, but by age becomes acid from oxidation of benzoic aldehyde (benzaldehyde) into benzoic acid, which change is more rapid when deprived of hydrocyanic acid.

**Tests:** 1. Oil 10 drops shaken with little alcohol — sodium hydroxide T. S. + 2 drops ferrous sulphate T. S. + 2 drops ferric chloride T. S., warmed and mixed with hydrochloric acid in excess produces blue precipitate (pres. of hydrocyanic acid). 2. Saturate with oil a strip of filter paper, ignite and immediately invert over it a beaker having inner surface moistened with water, which will absorb products of combustion, rinse beaker with little distilled water, filter, the filtrate should give no turbidity with few drops of silver nitrate T. S., or if

FIG. 170.



*Prunus Amygdalus*: fruit in the act of opening.

any it should disappear upon boiling (abs. of artificial oils containing chlorinated products). *Assay*: For benzaldehyde—see below, using 12 drops of oil; For hydrocyanic acid—Mix oil 1 Gm. with sufficient water and freshly precipitated magnesium hydroxide to make an opaque mixture of 50 Cc.; add 2–3 drops potassium chromate T. S. +  $\frac{N}{10}$  silver nitrate V. S. until red tint is permanent; 7.5–14.9 Cc. of latter should be required, each Cc. corresponding to 0.002684 Gm. of hydrocyanic acid. Should be kept dark, in small, well-stoppered, completely filled, amber-colored bottles. Dose,  $\mathfrak{m}\frac{1}{4}$ –1 (.016–.06 Cc.).

**PREPARATIONS.**—OIL: 1. *Aqua Amygdalæ Amaræ*. Bitter Almond Water. (Syn., Fr. Eau d'Amandes amères; Ger. Bittermandelwasser.)

*Manufacture*:  $\frac{1}{10}$  p. c. Oil .1 Cc. dissolved by agitation in distilled water q. s. 100 Cc. Dose,  $\mathfrak{z}\mathfrak{j}$ –3 (4–12 Cc.); mostly as a flavor.

2. *Spiritus Amygdalæ Amaræ*. Spirit of Bitter Almond. (Syn., Essence of Bitter Almond; Fr. Alcoolat (Esprit) d'Amandes amères; Ger. Bittermandelgeist.)

*Manufacture*: 1 p. c. Oil 1 Cc. dissolved in alcohol 80, then add distilled water q. s. 100 Cc. Dose,  $\mathfrak{M}\mathfrak{xv}$ –30 (1–2 Cc.).

*Prep.*: 1. *Syrupus Amygdalæ*. Syrup of Almond. (Syn., Fr. Syrupus Emulsivus, Sirop (d'Orgeat)—d'Amande—émulsif; Ger. Mandelsirup.)

*Manufacture*: Mix spirit of bitter-almond 1 Cc., orange flower water 10, syrup q. s. 100 Cc. Dose,  $\mathfrak{z}\mathfrak{i}\mathfrak{j}$ –4 (8–15 Cc.).

**PROPERTIES.**—Demulcent, nutrient, sedative; often produces urticaria.

**USES.**—Coughs, pulmonary troubles, flavoring.

*Poisoning*: Here have hydrocyanic acid symptoms; hence give emetics to induce vomiting, galvanism, brandy, whisky, ammonia to nostrils, etc.

#### *Allied Products:*

1. **Benzaldehydum**. Benzaldehyde,  $C_7H_6O$ , *official*.—(Syn., Oleum Amygdalarum Æthereum (Artificiale)-sine Acide Prussico, Synthetic Oil of Bitter Almond; Fr. Aldehyde benzoïque; Ger. Kunstliches Bittermandelöl.) An aldehyde produced artificially, or from natural oil of bitter almond or other oils, containing 95 p. c. of pure benzaldehyde.

*Manufacture*: Obtained from (1) oil of bitter-almond by shaking it with milk of lime + solution of iron sulphate, setting aside few days, distilling, thus converting hydrocyanic acid into Prussian blue, (2) toluene,  $C_7H_8$ , by converting it into benzyl chloride, or benzal chloride, the former,  $C_6H_5CH_2Cl$ , being heated with barium nitrate and water while passing  $CO_2$  through mixture, the resulting benzyl nitrate decomposing into benzaldehyde and oxides of nitrogen. It is a colorless, strongly refractive liquid, bitter-almond odor, burning, aromatic taste, sp. gr. 1.045, soluble in alcohol, ether, fixed and volatile oils, 300 parts water, oxidizes to benzoic acid— $C_6H_5CHO + O = C_6H_5CO_2H$ . *Assay*: Weigh 10 Cc. kerosene, add 12 drops benzaldehyde, again weigh, add

**DRUPACEÆ.**

20 Cc. distilled water + 6 drops phenolphthalein T. S., neutralize with  $\frac{N}{10}$  sodium hydroxide V. S., shake, add gradually 10 Cc. solution sodium sulphite (1 in 5), alternating with  $\frac{N}{2}$  hydrochloric acid V. S. to maintain neutrality, add few drops phenolphthalein T. S., shake, let stand 2 hours, note number Cc.  $\frac{N}{2}$  hydrochloric acid V. S. used. Carry out blank test omitting benzaldehyde, noting number Cc.  $\frac{N}{2}$  hydrochloric acid V. S. consumed; subtract Cc. of latter from former, multiply by 0.0526, then by 100, divide by weight of benzaldehyde taken = p. c. of purity. *Impurities*: Hydrocyanic acid, chlorinated products. Should be kept in well-stoppered, amber-colored bottles. Dose,  $m\frac{1}{4}$ –1 (.016–.06 Cc.).

**PROPERTIES AND USES.**—Similar to oil of bitter-almond; largely as a flavoring agent, having the advantage of the oil in being devoid of hydrocyanic acid, and not being poisonous except in large quantities.

2. *Nitrobenzene, Nitrobenzol, Oil of Mirbane.*—False artificial oil of bitter-almond is obtained by acting on benzene with nitric acid. It is very poisonous, has the true bitter-almond oil odor, owing to which substitution has been made with fatal results.

AMYGDALA DULCIS. SWEET ALMOND.

*Prunus Amygdalus*, var. *dulcis*, *De Candolle*. } The ripe seed.

*Habitat.* W. Asia, same as *amara*; cultivated in S. California.

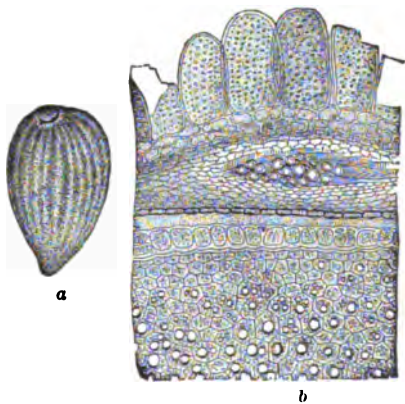
*Syn.* Jordan Almond, Greek Nuts; Fr. Amandes douces; Ger. Amygdalæ dulces, Süss Mandeln.

*Dul'cis.* L. sweet—i. e., the fruit.

**PLANT.**—About identical in every respect with var. *amara*. The seeds are, however, sweeter, broader, lighter testa, and with water yield an emulsion having no odor of hydrocyanic acid. Dose, *ad libitum*.

**Commercial.**—Of these we have several varieties (*Jordan, Valencia, Sicily, Barbary*, in order of value). They are imported chiefly from Spain, S. France, via Marseilles or Bordeaux (*soft-shelled*; var. *frag'ilis*), and Malaga (*Jordan* or *long*) or Valencia (*hard-shelled*), and are larger and longer than the var. *amara*, with more convex-sides. The Jordan, owing to their easy recognition, alone are used in the Br. P. To preserve almonds, should keep dry in order to prevent decomposition of amygdalin and fixed oil. When rancid the embryo has changed into gum bassorin, which renders them unfit for medicinal use.

FIG. 171.



*Prunus Amygdalus*: a, seed-kernel; b, section through seed-coats and portion of cotyledon.



**CONSTITUENTS.**—Fixed oil 56 p. c., Emulsin, (mucilage 3 p. c., sugar 6 p. c., proteids (myosin, vitellin, and conglutin) 24–30 p. c., precipitated by acetic acid, ash 3–5 p. c. = K, Ca, Mg—phosphates). The *testa* of both varieties contain tannin.

**Oleum Amygdalæ Expressum.** **Expressed Oil of Almond, official.**—(Syn., Oleum Amygdalæ Dulcis; Br. Oleum Amygdalæ; Fr. Huile d'Amande (douce); Ger. Oleum Amygdalarum, Mandelöl.) This fixed oil is obtained from bitter and sweet almonds by grinding or bruising in an iron or stone mortar the clean and perfect seeds, enclosing mass in canvas bags and subjecting them to hydraulic pressure of 350 atmospheres between polished steel plates slightly heated (30° C.; 86° F.); the expressed turbid oil is set aside in a cool place, decanted from sediment and filtered; the bitter-almond furnishes most. It is a straw-colored, oily liquid, nearly inodorous, mild, nut-like taste, sp. gr.

FIG. 172.

*Cydonia (Pyrus) Cydonia.*

FIG. 173.

*Malus (Pyrus) Malus.*

0.915, soluble in ether, chloroform, benzene, slightly in alcohol; contains triolein 75–85 p. c., tripalmitin, trilinolein. *Tests*: 1. Clear at —10° C.; 14° F., congeals at —20° C.; —4° F. (abs. of olive and lard oils, congealing at —5° C.; 22° F., apricot and peach oils, remaining fluid at —20° C.; —4° F.). 2. Oil 2 Cc. shaken with 1 Cc. nitric acid + 1 Cc. water gives whitish mixture, which upon standing some hours separates into a solid white mass and a slightly colored liquid (dis. from peach and apricot oils, which give red color, and sesame and cottonseed oils, which are colored brown.). Should be kept cool, in well-stoppered containers. Dose, ʒj–2 (30–60 Cc.).

**ADULTERATIONS.**—Olive, ground-nut (arachis), lard, sesame, poppy-seed, cottonseed, peach and apricot oils, the latter yielding 25–38 p. c., and with peach often substituted entirely for that of almonds.

**PREPARATIONS.**—I. SEED: 1. *Emulsum Amygdalæ.* Emulsion of

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Almond. (Syn., Br. *Mistura Amygdalæ*, Almond Mixture, Milk of Almonds, Simple Emulsion; Fr. *Lait d'Amandes*; Ger. *Mandelmilch*.)

*Manufacture*: 6 p. c. Triturate blanched sweet-almond 6 Gm., acacia 1, sugar 3, until mixed and then with water 90 Cc., strain, mix, add water q. s. 100 Cc. Should be freshly prepared when required. Dose, ʒij–4 (8–15 Cc.).

II. OIL: 1. *Emulsum Chloroformi*, 6 p. c. 2. *Emulsum Olei Terebinthinæ*, 5 p. c. 3. *Unguentum Aquæ Rosæ*, 56 p. c. 4. *Unguentum Veratrinæ*, 6 p. c.

*Unoff. Prep.*: *Pulvis Amygdalæ Compositus* (Br.)—seed 200 parts + sugar 100, acacia 25.

**PROPERTIES.**—Demulcent, nutrient, laxative.

**USES.**—The meal of the expressed cake as a toilet powder, and since it contains no starch it may readily be made into bread, cake, puddings, etc., which is excellent for diabetics. Seed very popular as a confection. Expressed oil, employed like olive oil, also for pulmonary trouble.

*Allied Plants*:

1. *Amygdalus* (*Prunus*) *Per'sica*, *Peach*.—Persia, cultivated largely in the United States, etc. Fruit edible, abounding in sugar, juice ferments, and upon distillation yields peach brandy; kernels poisonous from yielding HCN, often substituted for bitter almonds, also contain fixed oil resembling that of almond, for which it is an adulterant; leaves mild sedative in doses of gr. 15–30 (1–2 Gm.), in infusion.

2. *Cydo'nia* (*Py'rus*) *Cydonia*, *Quince*.—Pomaceæ. The seed, official 1850–1890; W. Asia. Tree 2.5–6 M. (8–20°) high, with crooked, straggling branches; leaves like pear leaves; flowers white or purplish; fruit pear-shaped; seed 6 Mm. ( $\frac{1}{4}$ ') long, ovate, triangular, brown, covered with whitish, mucilaginous epithelium, causing seeds of each cell to adhere; swell with water, forming heavy mucilage; 2 cotyledons, white, oily, bitter-almond taste; very similar to apple seeds. Contain mucilage (cydonin) 20 p. c. (not precipitated by borax or potassium silicate, soluble in cold and hot water), fixed oil, proteids; used as demulcent, protective; fruit astringent. *Mucilago Cydonii* (1 part + water 50), official 1880–1890.

3. *Ma'lus* (*Pyrus*) *Malus*, *Apple*.—Plant resembles quince; fruit edible, laxative; bark tonic, febrifuge. Dose, gr. 15–60 (1–4 Gm.).

### 36. MIMOSACEÆ. Mimosa Family.

Mi-mo-sa'se-e. L. *Mimos-a* + aceæ, fr. L. *mimus*, Gr.  $\mu\acute{\iota}\mu\omicron\varsigma$ , a mimic—i. e., the leaves often mimic or imitate animal sensibility, moving by slight impulse, partly closing when touched, etc. Herbs, shrubs, trees. Distinguished by leaves compound, 2–3-pinnate (sometimes phyllodia); calyx 3–6-toothed or lobed, corolla 3–6's, stamens distinct or monadelphous, ovary 1-celled, ovules several; fruit, legume; tropics, temperate climates; tonic, astringent, demulcent, nutritive, dye.

Genus: 1. **Acacia**.

## ACACIA. ACACIA.

**Acacia Senegal**, *Willdenow*, } A gummy exudation, from stem and  
and other species. } branches.

*Habitat.* E. and W. Africa, Senegal, Kordofan, Egypt, Abyssinia, India, Nubia.

*Syn.* Gum Arabic, Gum Senegal, Egyptian Thorn, Indian Gum Tree, Babla(c)h Pods, Acacia bambolah, Gummi Africanum, Gummi Mimosæ; Br. *Acaciæ Gummi*; Fr. *Gumme arabique vraie*; Ger. *Gummi Arabicum*, *Arabisches Gummi*.

*A-ca'cia.* L. fr. Gr. *akakia*, a thorny Egyptian tree; fr. *aci*, a point—i. e., tree studded with thorns.

*Sen'e-gal.* L. belonging to Senegal, a country and river in W. Africa—i. e., the plant's original and present habitat.

*Arabic*—misnomer, as Arabia produces little and exports none.

**PLANT.**—Shrubby tree, 6 M. (20°) high, with grayish-brown bark, growing in sandy soil, deserts, forming entire forests, with little other associated vegetation, along the Upper Nile; bears at each leaf-node 2 spines 6–12 Mm. ( $\frac{1}{4}$ – $\frac{1}{2}$ ') long; leaves alternate, bipinnate, paripinnate; pinnæ in 2 pairs; leaflets 8–10 pairs; flowers yellow; pod, loment, 7.5–10 Cm. (3–4') long, 18 Mm. ( $\frac{3}{4}$ ') wide, 2–6-seeded. Known by natives as *Verek* (Senegal) or *Hashabi* (E. Africa).

FIG. 174.

*Acacia Senegal.*

**GUM** (acacia), is a result of the transformation of the cell contents (cellulose) in the inner bark, where it sometimes occurs in small pouches; it forms most abundantly in hot, dry seasons, and in diseased

**MIMOSACEÆ.**

trees. It occurs in roundish tears of various sizes, or broken angular fragments, whitish, yellowish, translucent, brittle, glass-like, sometimes iridescent fracture; nearly inodorous; taste insipid, mucilaginous, insoluble in alcohol, slowly and completely soluble in water, forming odorless, acid mucilaginous liquid, precipitated by alcohol, basic lead acetate T. S., ferric chloride T. S., concentrated solution of sodium borate; not colored blue (starch) or red (dextrin) by iodine T. S., nor does it yield brownish-black precipitate with ferric chloride T. S., or reduce alkaline cupric tartrate V. S.; powder contains few or no starch grains or fragments of vegetable tissues, ash 4 p. c. Dose, *ad libitum*.

**ADULTERATIONS.**—**GUM**: Inferior, dark colored, opaque and insoluble gums, bdellium, rock salt, ligneous and earthy substances, dextrin in lumps; **POWDER**: Flour, rice flour, starch dextrin—all recognized by the microscope, and iodine test. The gum from quince seed, flax-seed, Irish moss, etc., often used as a substitute.

**Commercial.**—Acacia enters market mostly from Egypt, via Cairo, Alexandria, and Trieste, in bags, boxes, casks, and skins. It is received at these export points as unassorted acacia, "acacia in sorts"—the aggregated product of various species—, and there assorted into "first picked," "second picked," etc., down to the "sorts" (unworthy of assorting)—there being recognized, it is said, at Trieste thirty-two grades. The best gum is white and opaque, the largest producers of this being *A. Senegal* (*Ve'rek*) and *A. arabica* (*vera*); both grow associated with other species, all contributing the several commercial varieties:

1. *Turkey, Egyptian Gum.*—This includes: (a) Kordofan (*A. Senegal*), from west of White Nile; (b) Sennaar (*A. fistula*, *A. stenocarpa*), from east of White Nile (inferior, mucilage quickly sours); (c) Suakin, Talca (*A. stenocarpa*, *A. Se'yal*), from near Red Sea—this is very brittle, usually semi-pulverulent, is a mixture of white and brown pieces, and dissolves only with alkali.

2. *Senegal* (*A. Senegal*).—W. Africa, north of Senegal River. It is controlled by France and shipped to Bordeaux. The juice exudes through fissures caused by dry winds after the rainy season, or through artificial incisions. At first it is a thick liquid, which sooner or later (whereby changes the color) hardens on the bark similar to our cherry, apple, or plum gum. It is collected mostly Oct.–Dec., although some in March, by the Moors, and negroes who enter the acacia forests in caravans and gather it in leather sacks, picking from the ground the fallen pieces and detaching the adherent lumps with wooden axes. This is larger than Turkey gum (some nodules being the size of a pigeon egg), less brittle, more yellow or reddish, with fewer cracks and fracture more conchoidal. When heated with potassium hydroxide does not become amber-yellow, as do the Turkey gum and dextrin solutions.

3. *Barbary, Morocco, Mogador* (*A. nilotica*, *A. arabica*).—Collected July–August; two kinds enter Mogador, one from Morocco (resembles Turkey), the other from Timbuctoo (resembles Senegal);

both in more or less brownish, roundish tears, brittle, soluble in water.

4. *India* (*A. arabica* + other species).—From Somali districts, E. Africa, and conveyed by Arab vessels to Bombay. It is much mixed, resembling somewhat Turkey and Senegal gums. Often contains Bas-sora gum or allied substances (insoluble, but swelling and softening with water into a viscid mass), also resinous products resembling the turpentine. When these are culled out, this variety becomes well suited for general use.

Gums are produced also by other *Acacia* species in Morocco, Cape Colony, Australia, Brazil, etc.; the *Mezquite* gum (*Prosopis juliflora*), Tex., Cal., N. Mex., Chile, resembles gum arabic, but is yellow, brown, not precipitated by lead subacetate, ferric chloride, or borax; also considerable gum from plants differing in genera and family, all of which resemble the official, except are darker.

Powdered acacia occurs in two forms: 1. *Granulated* or *sanded*, to produce which the gum needs to lose only 2 p. c. of moisture. 2. *Finely powdered* (*dusted*), in which the gum must lose 10 p. c. of moisture to produce a sufficiently fine powder—a process that renders it more lumpy and less soluble in water.

CONSTITUENTS.—Arabic acid,  $C_{12}H_{22}O_{11}$ , combined with Ca, Mg, K—arabates; sugar (trace), moisture 14 p. c., ash 3–4 p. c.

**Arabic Acid** (*gummic acid, arabin*).—A glucoside obtained by adding alcohol to acidified (HCl) mucilage. After drying, it swells with water, but dissolves only upon the addition of an alkali; boiled with acids yields arabinose (arabin sugar, pectinose, pectin sugar),  $C_5H_{10}O_5$ , in prismatic crystals, sweet, but not directly fermentable, and possibly also galactose, granular and less sweet.

PREPARATIONS.—1. *Mucilago Acaciæ*. Mucilage of Acacia. (Syn., Fr. Mucilage (de Gomme arabique) arabique; Ger. Mucilago Gummi arabici, Gummischleim.)

*Manufacture*: 34 p. c. Wash acacia 34 Gm. with cold water, let drain, add to it lime water 33 Gm. + water q. s. 100 Gm., stir until dissolved, strain.

Lime water is used to neutralize the natural acidity from acid calcium arabate; when cold or hot water employed alone acetic acid is formed, which, however, may be retarded by using either alcohol 6 p. c., glycerin 10 p. c., acetanilide 0.4 p. c., or chloroform 0.5 p. c. Should be kept cool, in well-stoppered, completely filled bottles. Dose, *ad libitum*.

2. *Syrupus Acaciæ*. Syrup of Acacia. (Syn., Fr. Sirop de Gomme; Ger. Syrupus Gummosus, Gummisirup.)

*Manufacture*: Dissolve acacia 10 Gm. in distilled water 43 Cc., occasionally stirring, add sugar 80 Gm., heat on water-bath until dissolved, stirring, strain, add distilled water q. s. 100 Cc. Sometimes spoils in hot weather. Dose, *ad libitum*.

3. *Emulsum Amygdalæ*, 1 p. c. 4. *Emulsum Olei Morrhue*, 12.5 p. c. 5. *Emulsum Olei Morrhue cum Hypophosphitibus*, 12.5 p. c.

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6. *Emulsum Olei Terebinthinæ*, 15 p. c. 7. *Mistura Glycyrrhizæ Composita*, 3 p. c. 8. *Pilulæ Ferri Iodidi*,  $\frac{1}{4}$  gr. (.01 Gm.). 9. *Pilulæ Phosphori*,  $\frac{1}{2}$  gr. (.03 Gm.). 10. *Pilulæ Podophylli, Belladonnæ et Capsici*,  $\frac{1}{4}$  gr. (0.16 Gm.). 11. *Trochisci Cubebæ*, 2 gr. (.13 Gm.). 12. *Trochisci Glycyrrhizæ et Opii*, 2 gr. (.13 Gm.).

**PROPERTIES.**—Demulcent, emollient, protective, nutritive. Forms often the food of Hottentots and camels. By its viscosity sheaths inflamed surfaces; as a diluent, lessens acrimony of irritating medicines.

FIG. 175.

*Acacia arabica.*

**USES.**—Coughs, laryngitis, gastritis, typhoid fever, dysentery, diarrhoea. Fine powder locally stops slight hemorrhage. Thick mucilage protects burns, ulcers, etc. In pharmacy used to suspend insoluble substances in water—emulsifying oleoresins, fixed and volatile oils, for adhering pills, troches, etc. In arts for giving lustre to fabrics, silks, thickening colors, mordants, suspending iron tannate in ink, etc.

The bark of tree for dyeing, tanning, as it contains tannic and gallic acids.

*Allied Plants :*

1. *Acacia Cat'echu*, *Catechu*.—An extract prepared from the heart-wood, official 1820–1900 ; India, Hindustan. Plant crooked, shrubby tree, 4.5–12 M. (15–40°) high, 15–45 Cm. (6–18') thick, bark brown, wood whitish and reddish, leaves paripinnate, pinnæ in 10–20 pairs, with a pair of hooked, brown prickles at each base, leaflets 20–30 pairs

FIG. 176.



*Acacia Catechu.*

in each pinna, flowers yellow, fruit, pod (loment), brown, flat, 5–12.5 Cm. (2–5') long, seed 3–10, brown, shining ; extract (*catechu*) in irregular masses, dark brown, brittle, porous, fracture conchoidal, little glossy, inodorous, taste sweetish, astringent. It is prepared by removing bark and sapwood, and boiling in water the reddish-black heart-wood, cut in chips, for about 12 hours, straining, evaporating, stirring

## CÆSALPINACEÆ.

frequently and vigorously to improve the product—over-boiling being injurious as it converts catechin into catechu-tannic acid; when of syrupy consistency it is cooled somewhat and poured into clay moulds or on leaves, mats, etc., previously dusted with cow-dung ashes; by morning it is hard, brittle, when it is broken up into suitable pieces for market. There are several varieties.: 1. Plano-convex (Cake); 2. Pegu; 3. Quadrangular (Cake), Bengal; 4. Ball, Bombay. Contains catechu-tannic acid 35 p. c., catechin 13–34 p. c., quercetin, gum, extractive. *Adulterations*: Largely with leaves, mats, cloths, sticks, sand, ferrous carbonate, sometimes to 65 p. c.; artificial variety made from roasted mahogany, walnut, etc. Astringent, tonic, similar to tannic acid; diarrhoea, leucorrhœa, gonorrhœa, chronic sore throat, relaxed uvula, spongy gums (mouth wash), hemorrhages, bronchitis. Dose, gr. v–30 (.3–2 Gm.); compound tincture, 10 p. c. (diluted alcohol), dose, ʒss–2 (2–8 Cc.); fluidextract; infusion.

2. *A. arabica* (*ve'ra*), bark reddish-brown, spines and fruit long; *A. gummifera*, *A. Ehrenbergia'na*, *A. Adanso'nii*, *A. tor'tilis*, *A. Fistula*, and several others give valuable gums.

3. *A. Su'ma*.—Differs from *A. Catechu* only in its white bark, more leaflets, shorter corolla, and stronger spines. S. India, E. Africa (forests), S. America. Once furnished most of the commercial catechu, and still some; the bark is used in tanning. *A. arabica*, *Babul Bark*, India; furnishes good extract; the fruit contains tannin 22 p. c.

4. *Ar'eca Cat'echu*, *Areca* or *Betel Nut*.—Palmaceæ (see page 94). Palm tree cultivated in India. Extract made by evaporating decoction of the powdered nuts.

## 37. CÆSALPINACEÆ. Senna Family.

Ses-al-pi-na'se-e. L. *Cæsalpin-us* + *acææ*, after Andreas Cæsalpinus (1519–1603), a noted Italian botanist and physician. Trees, herbs, shrubs. Distinguished by leaves compound, bipinnate, stipulate, stems often prickly; flowers yellow or red, calyx 5's, petals 5, upper one enclosed by lateral ones in bud; fruit legume, dehiscent; tropics; astringent, cathartic, tonic, diuretic, dye.

Genera: 1. *Cassia* (*Cathartocarpus*). 2. *Tamarindus*. 3. *Hæmatoxylon*. 4. *Copaiba*.

## CASSIA FISTULA. CASSIA FISTULA.

*Cassia Fistula*, Linné. }  
(*Cathartocarpus Fistula*, (Linné) Persoon.) } The dried fruit.

*Habitat*. E. India, Egypt; naturalized in Africa, W. Indies, Brazil; cultivated.

*Syn*. Purging Cassia, Cassia Stick Tree, Pudding Pipe or Stick Tree, Drumstick Tree, Indian Laburnum; Br. Cassia Pulpa; Fr. Casse officinale,—en Bâtons—mondée; Ger. Purgiercassie, Fistelkassie, Röhrenkassie.

*Cas'si-a*. Gr. *κασία*, fr. Heb. *qetsi-oth*, *qulsa*, cut—i. e., bark of some species cut off and used; classical name of a bark allied to cinnamon.

*Fis'tu-la*. L. *fistula*, a pipe, cane—i. e., the resemblance of the long, slender fruit.

*Oa-thar-to-car'pus*. L. fr. Gr. *καθαίρειν*, *καθαρτικός*, cleansing, purgative, + *καρπός*, fruit—i. e., its medicinal property.



**PLANT.**—Handsome tree, 9–15 M. (30–50°) high, bark gray ; leaves paripinnate, alternate, large ; leaflets opposite, 3–7 pairs, 5–15 Cm. (2–6') long, ovate ; flowers May–June, 2.5–5 Cm. (1–2') wide, golden-yellow. **FRUIT**, cylindrical, 25–50 Cm. (10–20') long, 20 Mm. ( $\frac{4}{3}$ ') thick, blackish-brown, on one side longitudinal groove (ventral), on the other a smooth line or slight ridge (dorsal), indicating the two sutures ; indehiscent, faint transverse striations, cavity divided transversely into 25–100 compartments, each containing a reddish-brown, glossy, flattish-ovoid seed, 8 Mm. ( $\frac{1}{3}$ ') long, embedded in blackish-brown pulp, having prune-like odor, mawkish, sweet taste. Dose, 3j–2 (4–8 Gm.).

FIG. 177.

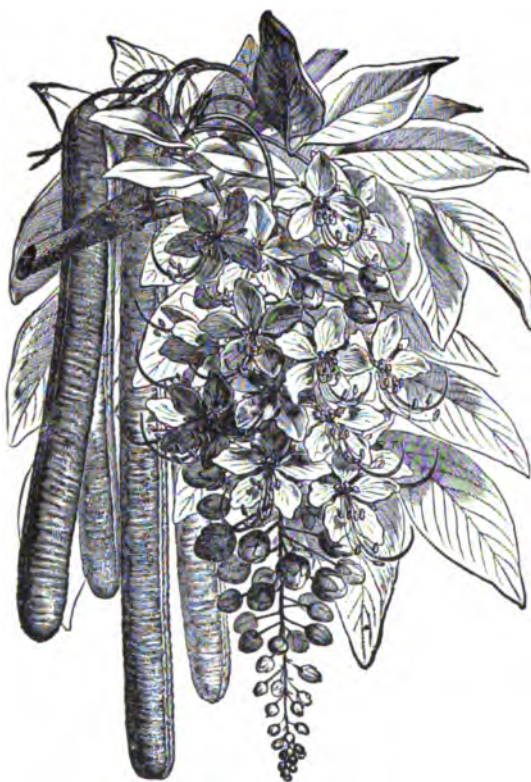
*Cassia Fistula.*

FIG. 178.

*Cassia Fistula* : Part of pod.  
natural size.

**Commercial.**—Imported from E. and W. Indies, but mostly from the latter and S. America. Legumes that are heavy and do not rattle when shaken are best, as they contain most pulp (the official portion used), which should be at least 30 p. c. This is extracted by boiling in water, evaporating, or when fresh by removing pulp with knives ; it becomes mouldy and sour by age.

CESALPINACEÆ.

CONSTITUENTS.—(of pulp): Sugar 60 p. c., mucilage, pectin, albuminoids, volatile oil, butyric acid, calcium oxalate.

PREPARATIONS.—1. *Confectio Sennæ*, 16 p. c.

*Unoff. Prep.*: *Confection (Confectio Cassiæ)*, 50 p. c.

PROPERTIES AND USES.—Laxative for costiveness, to promote flow of bile. Generally combined with other drugs (manna, tamarinds, salines, etc.), owing to its occasioning colic and flatulence.

*Allied Plants*:

1. *Cassia moscha'ta*, Colombia, and *C. bacilla'ris*, Dutch Guiana (Surinam)—both have fruit, .3–.5 M. (12–20') long, 15 Mm. ( $\frac{3}{8}$ ') thick; *C. gran'dis* (*C. brasilia'na*), Brazil—fruit, .6 M. (24') long, laterally compressed, 4 Cm. ( $1\frac{3}{8}$ ') broad, blackish, coarsely veined, sutures prominent in 3 ridges. While the first two species are lighter in color, all three have about the same properties as the official, except are more nauseating.

SENNÆ. SENNA.

*Cassia* { *acutifolia*, *Delile*,  
          *angustifolia*, *Vahl*. } The dried leaflets.

*Habitat.* E. and C. Africa, India.

*Syn.* 1. Br. Senna Alexandrina, Alexandrian, Tripoli, or Nubian Senna; Fr. Séné d'Alexandrie; Ger. Alexandrinische Senna. 2. Br. Senna Indica, East Indian, Arabian, Bombay, Mecca, Mocha, or Tinnevely Senna; Fr. Séné de Tinnevely, Feuilles de Séné; Ger. Folia Sennæ, Sennesblätter, Indische Senna.

*A-cu-ti-fo'li-a.* L. *acutus*, sharp, + *folium*, leaf—i. e., leaves sharp pointed.

*An-gus-ti-fo'li-a.* L. *angustus*, narrow, + *folium*, leaf—i. e., leaves narrow.

*Senna.* L. fr. Ar. *sana*, *sena*. Hind. *sena*—i. e., native Arabian plant name; this is the subgenus of *Cassia*, but should have held full generic rank.

PLANT.—1. *Cassia acutifolia*, *Alexandria Senna*. Small shrub, .6–1 M. (2–3°) high; stem erect, woody, branching, whitish; flowers large, yellow, axillary raceme, fruit legume, 5 Cm. (2') long, 18 Mm. ( $\frac{3}{4}$ ') wide, flat, oblong, smooth, membranous, nearly straight, indehiscent, grayish-brown, bivalvular, 6–7-celled, each with a hard, cordate, ash-colored seed; leaves alternate, 4–5 pairs, paripinnate, footstalks glandless, 2 small-pointed stipules at base. LEAFLETS, 25 Mm. (1') long, 10 Mm. ( $\frac{3}{8}$ ') broad, short stout petioles, inequilaterally lanceolate or lance-ovate, acutely cuspidate, entire, subcoriaceous, brittle, pale green or grayish-green, sparsely and obscurely hairy, especially beneath, the hairs appressed, 1-celled, thick-walled; odor characteristic; taste somewhat mucilaginous, bitterish. Should be free from stalks and Argel (*Solenostem'ma Ar'gel*) leaves, which are equilateral, 1-veined, thick, wrinkled, glaucous, hairs 3-celled.

2. *Cassia angustifolia* (*elongata*), *India Senna*. Plant like *acutifolia* except fruit 6 Cm. ( $2\frac{2}{3}$ ') long, 15 Mm. ( $\frac{3}{8}$ ') broad, narrower, oblong, 8-seeded; leaves paripinnate, 5–8 pairs, sessile. LEAFLETS, 25–50 Mm. (1–2') long, 10–15 Mm. ( $\frac{2}{3}$ – $\frac{3}{8}$ ') broad, inequilaterally lanceolate, entire, thin, more abruptly pointed than Alexandria, yellowish-green, and smooth above, paler beneath; odor characteristic; taste somewhat mucilaginous, bitterish. Should be without stalks, discolored leaves,

and other admixtures. *Solvents*: water or diluted alcohol extracts the active constituents (*emodin*, *chrysophanic acid*); a decoction made by long boiling is inert, being rendered more so by the addition of an alkali or acid. Leaves by percolation with alcohol are deprived of their gripping resinous constituent, odor, taste, and color, but still retain their pleasant cathartic power, this, however, being slightly lessened. Dose, 3ss-3 (2-12 Gm.).

**ADULTERATIONS.**—*Alexandria*. 1. *C. obovata*, leaflets, called by Arabs *Senna Baladi* (Wild Senna), and considered in Egypt less valuable than *Senna Jebeli* (Mountain Senna, *C. acutifolia*). 2. *Solenostemma Argel*, leaves which have lateral veins indistinct, leathery,

FIG. 179.



*Cassia acutifolia*: half natural size; A, leaflets; B, legumes.

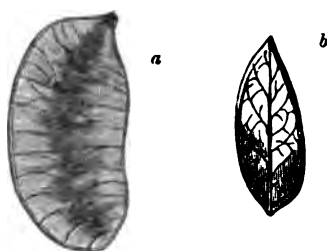
wrinkled, bitter; flower buds present; fruit pear-shaped. 3. *Cracca* (*Tephrosia*) *Apollinea*, leaflets, S. Europe, uneven base, obovate, emarginate (poisonous). 4. *Coriaria myrtifolia*, leaves (poisonous), and

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*Colutea arborescens*, leaflets formerly used. 5. *Pods, leaf-stalks, branches.* All these are now carefully garbled out. The Arabians preferred the pods, as they contain 25 p. c. more cathartic principle than the leaflets, and no resin or volatile oil, hence do not gripe. Six or eight pods infused in 3ij (60 Cc.) of water will purge an adult.

*Commercial.*—We have several varieties; 1. *Alexandrian, Nubian.* Chiefly from Nubia (Sennaar, Kordofan), but some from Timbuctoo, usually forwarded via Assouan, Darao, thence by the Nile to Cairo and Alexandria; its botanic source has received various synonyms, as *Cassia acutifolia*, *C. lanceolata*, *C. lenitiva*, *C. officinalis*, *C. æthiopica*, *C. orientalis*, etc. *Tripoli Senna*, from Tripoli (interior Africa), has no doubt the same botanic source; it is conveyed to market ports by caravans, and is as a rule much broken and discolored, being mixed with legumes, stalks, and earthy matter, but no foreign leaves; seldom reaches our country, and by some restricted to *C. æthiopica* (*C. oborata*, *C. ovata*). These do not grow in Arabia or India.

FIG. 180.



*Cassia acutifolia*: a, legume; b, leaflet, about natural size.

2. *Indian, Arabian (Mocha), Tinnevelly.*—Originally produced in S. Arabia, but entered market via India (Bombay, Calcutta, etc.). The plant, *Cassia angustifolia* (*C. elongata*, *C. medica*), although indigenous to Arabia, grows wild in the interior of Africa, and is cultivated extensively at Tinnevelly (from Arabian seeds), in S. India, where it becomes most luxuriant, furnishing the finest, as well as purest leaflets, owing to freedom from legumes, stalks, and other adulterations. These are exported mostly from Tuticorin, and Madras. *Bombay, E. India Senna*, is sold frequently as Tinnevelly, has the same source, but is dried less carefully, containing often small and discolored leaflets. *Arabian, Mecca Senna*, is sold often as Bombay, being collected and dried with even less care, as it contains many brown leaflets and legumes.

Senna yields two annual crops of leaflets; the larger (best) in September, at the end of the rains, the smaller in April, during the dry season. Natives cut down the plants, expose them upon rocks to the hot sun until dry, strip and pack the leaflets in palm-leaf bags, then convey these on camels to the market ports, where the drug is garbled, put into large bales, and thus sent into other countries.

CONSTITUENTS.—Anthraglucosennin, Emodin, Chrysophanic acid, Glucosennin, Isoemodin, Sennarhamnetin, Sennanigrin, gum, resin, catharto-mannite (non-fermentable sugar), isomeric with quercite, sennapicrin, oxalic, malic, tartaric acids, combined with calcium, volatile oil (developing after drying).

**Anthraglucosennin.**—Tschirch obtained this from a weak ammoniacal percolate, found it to be a complex brownish-black powder, reducing Fehling's solution, only a part being soluble in ether; this ether-soluble portion when boiled with toluene to a partial solution and poured into benzin gives a precipitate—(*senna*-)emodin, melting at  $223^{\circ}\text{C}$ . ( $434^{\circ}\text{F}$ .), while in the mother-liquor remains—(*senna*-)chrysophanic acid, obtained by evaporation; the toluene-insoluble portion is an emodin glucoside—*glucosennin*,  $\text{C}_{22}\text{H}_{18}\text{O}_8$  (yellow amorphous

FIG. 181.



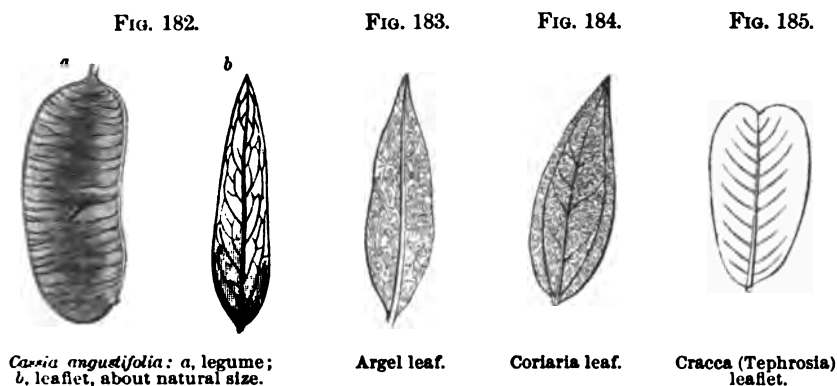
*Cassia angustifolia*: half natural size; A, leaflets; B, legumes.

powder). The ether-insoluble portion when treated with acetone and shaken with benzin yields—(*senna*-)isoemodin,  $\text{C}_{15}\text{H}_{10}\text{O}_5$  (isomeric with

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(senna-)emodin, but differs in being soluble in benzin); the acetone solution retains—*sennarhamnetin* (reddish-brown powder, differing from rhamnetin in not fluorescing in sulphuric acid solution); the anthra-glucosennin residue left after treatment with ether and acetone is a black, amorphous powder, which treated with alcoholic potash yields—(senna-)emodin and (senna-)chrysophanic acid.

From an aqueous percolate Tschirch extracted cathartic acid and a crystalline body,  $C_{14}H_{10}O_5$ , having similar reactions as sennanigrin, but concludes that the cathartic action (peristalsis) is due solely to the emodin and chrysophanic acid, both being oxymethylantraquinones. Formerly senna was believed to contain: cathartic (cathartinic) acid, sennapicrin, sennacrol (resin causing griping), chrysophan, and phæretin (yellow coloring matters), sennite (cathartomannite), mucilage, ash 10–12 p. c.



*Cassia angustifolia*: a, legume;  
b, leaflet, about natural size.

Argel leaf.

Coriaria leaf.

Cracca (Tephrosia)  
leaflet.

**PREPARATIONS.**—1. *Confectio Sennæ*. Confection of Senna. (Syn., Electuarium de Senna Compositum, Electuarium Lenitivum, Lenitive Electuary; Fr. Electuaire de Séné composé; Ger. Electuarium e Senna, Sennalatwerge.)

*Manufacture*: 10 p. c. Digest cassia fistula 16 Gm., tamarind 10, prune 7, fig 12, with water 65 Cc.; strain, add sugar 55.5 Gm., evaporate to 89.5, then add senna 10, coriander oil, 0.5, incorporate thoroughly while warm. Dose, 3j–2 (4–8 Gm.).

2. *Fluidextractum Sennæ*. Fluidextract of Senna. (Syn., Extractum Sennæ Fluidum, U. S. P. 1890; Br. Liquor Sennæ Concentratus; Fr. Extrait liquide de Séné; Ger. Flüssiges Sennaextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., reject percolate, remove powder from percolator, dry, moisten and percolate with diluted alcohol q. s., evaporate to 100 Cc. Dose, 3ss–2 (2–8 Cc.).

Preps.: 1. *Syrupus Sennæ*. Syrup of Senna. (Syn., Fr. Sirop de Séné; Ger. Sennasirup.)

*Manufacture*: 25 p. c. Mix fluidextract of senna 25 Cc., oil of coriander .5, syrup q. s. 100 Cc. Dose, 3ss–4 (2–15 Cc.).

2. *Syrupus Sarsaparillæ Compositus*, 1.5 p. c. (fluidextract of senna).



3. *Infusum Sennæ Compositum*. Compound Infusion of Senna. (Syn., Black Draught; Br. *Mistura Sennæ Composita*; Fr. *Tisane de Séné composé*; Ger. *Wiener Trank*, *Sennaaufguss*.)

*Manufacture*: 6 p. c. Macerate half an hour senna 6 Gm., manna 12, fennel 2, in boiling water 80 Cc.; strain, express, add magnesium sulphate 12 Gm., strain, add cold water q. s. 100 Cc. Dose,  $\bar{5}$ j– $\bar{3}$  (30–90 Cc.).

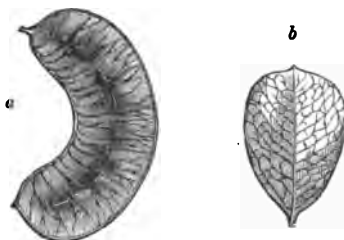
4. *Pulvis Glycyrrhizæ Compositus*, 18 p. c.

*Unoff. Preps.*: *Extract*, dose, gr. 5–20 (.3–1.3 Gm.). *Infusum Sennæ* (Br.), 10 p. c. + ginger .6 *Tinctura Sennæ Composita* (Br.), 20 p. c. *Species Laxantes St. Germain*.

**PROPERTIES.**—Cathartic, acts on nearly the entire intestinal tract (especially colon), increasing peristalsis and intestinal secretion, except biliary; produces in 4 to 6 hours copious yellow stools, with griping and flatulence; does not cause hypercatharsis nor constipation. Large dose vomits, purges, with severe tenesmus, but never poisons; the odor acts as a cathartic on very susceptible persons.

**USES.**—Arabians used it in skin affections; now employed for habitual constipation, hemorrhoids, fissura ani, fevers. Its smell, taste, nauseousness, injurious effects in hemorrhoids, intestinal hemorrhage, and inflammation, all lessen its popularity; its purgative

FIG. 186.



*Cassia obovata*: a, legume; b, leaflet, about natural size.

action is increased by bitters, calumba, etc., while the griping and nausea are diminished by coriander, tamarind, manna, fennel, Epsom or Rochelle salt. If leaves be macerated long in water, or if the mass be pressed tightly, much acrid, resinous principle will be obtained, causing griping, hence should exhaust by rapid percolation.

*Allied Plants*:

1. *Cassia obovata*.—Leaflets, official 1830–1870. This was the first senna known, being introduced by the Moors into Europe as early as the ninth century, where even in the sixteenth it became largely cultivated. Grows wild on sandy soil in Egypt, Nubia, Abyssinia, Tripoli, Senegal, Arabia, India; cultivated in Jamaica, being called *Port Royal* or *Jamaica Senna*; leaves 5–7 pairs, leaflets obovate, obtuse.

2. *C. marylandica*.—Leaflets, official 1820–1880. United States, New England to S. Carolina, west to the Mississippi. Plant 1–1.5

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M. (3–5°) high; leaves alternate, leaflets, paripinnate, 8 pairs, 2.5–5 Cm. (1–2') long, 12 Mm. ( $\frac{1}{2}$ ') wide; flowers August, yellow; fruit pod, 7.5 Cm. (3') long; in sandy soil, river banks, introduced into England in 1723, cultivated for ornament, collected Aug.–Sept.; contains cathartic acid, volatile oil, and is given in one-third larger doses than the official varieties; in infusion.

3. *C. pubes'cens* (*C. holoseric'ea*), *Aden Senna*.—Abyssinia, rarely met with now; leaflets 2.5 Cm. (1') long, ovate, mucronate, hairy, sometimes mixed with Mecca senna. *C. brev'ipes*. *C. America*; leaflets resemble Indian senna, but have 3 longitudinal veins; infusion non-purgative.

4. *Dip'teryx odora'ta*, *Tonka Bean*. Guiana. Large tree; fruit oblong-ovate, single-seeded; seed used in medicine, 4 Cm. ( $1\frac{2}{3}$ ') long, compressed, rounded at each end, testa dark brown, thin, wrinkled, somewhat glossy, often covered with small white crystals of coumarin; kernel light brown, oily; odor agreeably aromatic, resembling vanilla; taste bitter, aromatic; contains coumarin (cumarin),  $C_9H_6O_2$ —anhydride of coumaric acid, the odorous principle in sublimable crystals, fixed oil 25 p. c., sugar, mucilage. There are two varieties: 1. Dutch; 2. English. Narcotic, stimulant, paralyzant to the heart; whooping-cough (fluidextract), as a flavoring ingredient—cigars, sachets, etc. Dose, gr. 5–10 (.3–.6 Gm.).

5. *Melilo'tus officina'lis* and *Melilotus altis'simus*, *Sweet Clover*. The flowering tops; Europe, United States. Plants 1–1.5 M. (3–5°) high, flowers yellow and white, in racemes on angular stems; leaves serrate, trifoliate; odor fragrant, honey-like, especially when in bloom, which becomes stronger and more agreeable upon drying, resembling tonka bean; taste aromatic, bitter; contains coumarin (chief constituent of tonka bean), melilotic acid, coumaric acid, melilotol (fragrant volatile oil). Used mostly locally to allay pain in abdomen, joints, etc.; plasters, ointments, infusion, decoction.

6. *Trigonell'a Fœnum-græ'cum*, *Fenugreek*. The seeds; India, Europe; cultivated in France, Germany, etc. Annual herb, .3 M. (1°) high, leaves trifoliate, leaflets dentate, flowers yellowish, fruit compressed legume containing 16 seeds; seeds 3 Mm. ( $\frac{1}{8}$ ') long and broad, 2 Mm. ( $\frac{1}{12}$ ') thick, rhombic, flattened, brownish-yellow, large diagonal groove; strong aromatic, to some pleasant, odor; taste mucilaginous, bitter; contains volatile oil, fixed oil 6 p. c., mucilage 28 p. c., proteids 22 p. c., bitter principle, choline, trigonelline 0.13 p. c. Powder sometimes adulterated with ground amylaceous seeds. Used similar to flaxseed, elm, althæa; emollient cataplasms, enemata, ointments, plasters, decoction, 5 p. c. (usually thick and slimy); demulcent in veterinary condition-powders.

7. *Trifo'lium pratense*, *Red Clover*, and *Trifolium re'pens*, *White Clover*. Both used as alterative, deobstruent, sedative; whooping-cough, spasmodic affections; infusion.



RECAPITULATION No. 4.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Papaveraceae</i> : 1. <i>Opium</i> . 2. <i>Opium</i> .	<i>Papaver somniferum</i> .	Concrete milky exudation.	W. Asia.	Morphine, narcotine, codeine, narceine, meconic acid, etc.	Acet. extr., tr. tr. o. deod., tr. ip. et vin., pil., pulv. ip. et o., troch. glycyrrh. et o., emp., o. deod., pulv. morph. co.	Narcotic, sedative, anodyne.	Diarrhœa, peritonitis, cholera morbus, coughs, rheumatism, etc.	Grains. 1-2 (.06-13 Gm.).
1. <i>Sanguinaria</i> . 2. <i>Sanguinaria</i> .	<i>Sanguinaria canadensis</i> .	The dried rhizome.	N. America.	Chelerythrine, sanguinarine, protopine, $\beta$ -homochelidonine, starch, resins.	Fluidextract, tincture.	Emetic, stimulant, tonic, alterative, narcotic.	Bronchitis, croup, asthma, pneumonia, dyspepsia, jaundice, syphilis.	1-30 (.06-2 Gm.).
<i>Cruciferae</i> : 1. <i>Sinapis Alba</i> . 2. White Mustard.	<i>Sinapis alba</i> .	The seed.	Asia, South Europe.	Fixed oil, sinalbin, sinapine sulphocyanide, myrosin.	.....	Stimulant, emetic, tonic, diuretic, laxative, rubefacient, condiment.	Dyspepsia, delirium tremens, dropsy, poisoning, rheumatism, gout, colic, headache, etc.	15-60 (1-4 Gm.).
1. <i>Sinapis Nigra</i> . 2. Black Mustard.	<i>Brassica nigra</i> .	The seed.	Asia, South Europe.	Fixed oil, sinigrin, sinapine sulphocyanide, myrosin.	Charta.			
<i>Hamamelidaceae</i> : 1. <i>Hamamelidis Cortex</i> . 2. <i>Hamamelidis Folia</i> . 3. <i>Hamamelidis Leaves</i> .	<i>Hamamelis virginiana</i> .	The bark and twigs.	N. America.	Tannin, bitter principle, volatile oil.	Aqua.	Astringent, sedative, tonic.	Hemorrhages, tumors, hemorrhoids, varicose veins.	30-60 (2-4 Gm.).
		The dried leaves.	.....	.....	Fluidextract.			
1. <i>Styrax</i> . 2. <i>Stora</i> .	Liquidambar orientalis.	The balsam.	Asia Minor.	Styrac, styracin, cinchonic and benzoic acids, storesin, vanillin.	Tinct. benzoin comp.	Stimulant, expectorant, diuretic, antiseptic.	Bronchitis, catarrhs, gleet, phthisis, asthma, amenorrhœa.	10-30 (4-2 Gm.).
<i>Rosaceae</i> : 1. <i>Rubus</i> . 2. <i>Rubus</i> .	<i>Rubus villosus</i> , <i>nigrolaureus</i> , <i>caucasicus</i> .	The dried bark of the rhizome.	N. America.	Tannin, gallic acid, villosin.	Fluidextract, syrup.	Astringent, tonic.	Summer complaint, infantile diarrhœa.	30-60 (2-4 Gm.).

1. <i>Rosa gallica</i> . 2. Red Rose.	<i>Rosa gallica</i> .	The dried petals.	W. Asia.	Volatile oil, mucilage, sugar, tannin, quercitrin.	Confection, fluid-extract, syrup, med. pbl. aloes and mastic.	Hemorrhages, apthae, ulcers, inflamed eyes, favoring, pertumery.	1-4 Gm.). oil exte- rally.
1. <i>Oleum Rosae</i> . 2. Oil of Rose.	<i>Rosa damascena</i> .	The volatile oil.		Rhodinol, citronellol, stearopten.	Water, ung. eq. rose.	<i>Rosa damascena</i> , rhinitis.	15-30 (1-2 Gm.).
1. Quillaia (Quillaja). 2. Quillaia.	Quillaia Saponaria.	The dried inner bark.	Chile, Peru.	Saponin, starch, gum, Ca oxalate, CaSO <sub>4</sub> .	Tincture, fluid-extract.	Stimulant, detergent, antihelmintic, tenifuge.	120-360 (8-24 Gm.).
1. Cusco. 2. Kousso.	Hagenia abyssinica.	The dried pistillate flowers.	Abyssinia.	Kosin, kosotoxin, tannin, volatile oil.	.....	Tape-worms, lumbricoid worms.	30-40 (2-4 Gm.).
<i>Drupaceae</i> : 1. Prunus Virginiana. 2. Wild Cherry.	Prunus serotina.	The bark.	N. America.	Amygdalin, emulsin, bit. prin., tannin, resin, gallic acid.	Fluid-extract, infusion, syrup.	Consumption, cough, scrofula, dyspepsia, debility, intermittent.	ad lib.
1. Prunum. 2. Prune.	Prunus domestica.	The ripe fruit.	W. Asia.	Sugar, malic acid, pectin, fixed oil, amygdalin, emulsin.	Confection of senna.	Constipation.	ad lib.
1. Amygdala Amara. 2. Bitter Almond.	Prunus Amygdalus var. amara.	The ripe seed.	W. Asia.	Fixed oil, amygdalin, emulsin, proteids, mucilage, sugar.	Oil: water, spirit, syrup.	Coughs, pulmonary affections, favoring.	ad lib.
1. Amygdala Dulcis. 2. Sweet Almond.	Prunus Amygdalus var. dulcis.	The ripe seed.	W. Asia.	Fixed oil, emulsin, mucilage, sugar, proteids.	Emul. Oil: ung. aque rose.	Diabetes, confecti- onary.	ad lib.
<i>Mimosaceae</i> : 1. Acacia. 2. Acacia.	Acacia Senegal.	The gummy exudation.	E. and W. Africa.	Arabic acid, combined with Ca, Mg, K, sugar.	Mucilage, syrup, mist. glycyrr. co., pulv. cretae co., emul. amygd., pills, troches.	Coughs, gastritis, dysentery, hemorrhages, typhoid, emulsifier, expectant.	60-120 (4-8 Gm.).
<i>Caciphiaceae</i> : 1. Cassia Fistula. 2. Cassia Fistula.	Cassia Fistula.	The dried fruit.	East India.	Sugar, mucilage, pectin, calcium oxalate.	Confection of senna.	Constipation, promotes bile flow.	30-180 (2-12 Gm.).
1. Senna. 2. Senna.	Cassia acutifolia, angustifolia.	The dried leaflets.	E. and C. Africa, India.	Anthragnosennin, emodin, chrysophanic acid, glucosennin, isoenodin, sennamannin, sennanigrin.	Confection, fluid-extract, comp. infusion, syrup, pulv. glycyrr. comp., syr. sars. co.	Constipation, hemorrhoids, fissures, fevers.	

## TAMARINDUS. TAMARIND.

**Tamarindus** } The preserved pulp of the fruit.  
**indica**, Linné. }

*Habitat.* India, Africa, Nubia, Abyssinia; naturalized in W. Indies, Jamaica.

*Syn.* Black (E. India) Tamarinds, Indian Dates; Fr. Tamarinier (pulpe); Ger. Pulpa Tamarindorum cruda—depurata, Fructus Tamarindorum, Tamarindenmus.

**Tam-a-rin'dus.** L. fr. Ar. *tamr Hindi*, the Indian date, *tamr*, date. Heb. *tamar*, a palm tree, + *Hindi*, Indian, *Hind*, India—i. e., its native name.

**In'di-ca.** L. *indicus*, Gr. *Ἰνδικός*, pertaining to India—i. e., flourishes natively there.

*Tam'a-rind.* E. simply a contraction of the Arabic name.

**PLANT.**—Large, handsome tree, 18–24 M. (60–80°) high, branches widely spreading, bark rough, ash-colored, twigs smooth or pubescent; leaves paripinnate, alternate; leaflets 8–16 pairs, sessile, 12–25 Mm. ( $\frac{1}{2}$ –1') long, 6 Mm. ( $\frac{1}{4}$ ') broad, entire, unequal at base, oblong, yellowish-green; flowers yellow, calyx yellow, petals yellow with red

FIG. 187.

*Tamarindus indica.*

FIG. 188.



Tamarind fruit: cross-section: *ep*, epicarp; *me*, mesocarp; *en*, endocarp; *s*, seed.

veins, lateral racemes. Fruit, indehiscent legume, pendulous, compressed, 7.5–15 Cm. (3–6') long, 2.5 Cm. (1') wide, curved, smoothish, chocolate-brown, pericarp thin, corky. **PULP** (tamarind), a pulpy mass, light reddish-brown, darkening with age to dark brown, containing some branching fibres, 3–10 reddish-brown, smooth, oblong or quadrangular, compressed seeds, each enclosed in a tough membrane; odor distinct; taste sweet, agreeably acid. Bright iron left in contact with moist pulp 30 minutes should not show reddish deposit of copper. Dose, 3ss–5 (2–20 Gm.).

**Commercial.**—This beautiful tree flourishes in forests and by cultivation for its fruit, shade, and sweet-scented flowers. We have three varieties: 1. *W. Indian, Brown, Red*, official. Shells are removed and the inner part of the fruit is pressed or worked into cakes with sugar or hot syrup. Sometimes alternate layers of pulp and sugar are met

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with, or a somewhat homogeneous mass, as a result of boiling in copper vessels; enters market in jars.

2. *E. Indian, Black*.—Firm, clammy, black masses, consisting of seeds, pulp, fibres, and shell remains pressed together and dried by the sun, thus being preserved usually without sugar or syrup; has strong acid taste.

3. *Egyptian*.—Flat round cakes, 10–20 Cm. (4–8') wide, 2.5–5 Cm. (1–2') thick, firm, black, prepared by kneading the softer parts without sugar, very acid, frequently mouldy. The two last varieties seldom reach this country.

CONSTITUENTS.—Tartaric acid 5–9 p. c., Citric acid 4–6 p. c., Potassium bitartrate 5–6 p. c., malic acid, acetic acid (mostly as potassium salts), sugar, pectin, tannin (in seed-testa), insoluble matter 12–20 p. c.

PREPARATIONS—1. *Confectio Sennæ*, 10 p. c.

*Unoff. Preps.*: *Conserve* (*Conserve Tamarindī*), 25 p. c. *Infusion*. *Whey*. *Tamar Indien* (confection of senna with oils of anise and lemon).

PROPERTIES.—Laxative, refrigerant.

USES.—The Arabians employed it in malaria, also to heal aphthous sores, correct nausea, quench thirst, and allay febrile excitement. Now used mainly as a cooling drink in febrile diseases. It should be mixed with hot water (infusion) or boiled with milk (whey) and drank after the strained liquid has cooled. Usually combined with other laxatives, as a flavoring, which is claimed by some to lessen their cathartic power. Fresh leaves and flowers, being acid, are used natively for preparing cooling drinks; the seeds as astringent in bowel affections, and the kernels as a food.

## HÆMATOXYLON. HÆMATOXYLON.

*Hæmatoxylon campechianum*, Linné. } The heartwood.

*Habitat*. C. America; naturalized in W. Indies, Jamaica, St. Domingo.

*Syn*. Logwood, Blackwood, Campeachy Wood or Logwood, Jamaica, Honduras or St. Domingo Logwood, Lignum Cœruleum; Br. Hæmatoxyli Lignum; Fr. Bois (de Campeche, de Sang, d'Inde); Ger. Blauholz, Blutholz, Campecheholz.

*Hæm-a-tox'y-lon*. L. fr. Gr. *αἷμα* (τ), blood, + *ξύλον*, wood—i. e., color of the duramen.

*Cam-pe-ohi-a-num*. L. Campeachy, of or belonging to Campeachy Bay—i. e., its habitat.

*Log'wood*. So called from being imported in logs.

PLANT.—Small spreading tree, 7.5–12 M. (25–40°) high, .3–.6 M. (1–2°) thick; trunk irregular, knotty, hard, tough; branches crooked, straggling; bark dark, rough, white-dotted; leaves paripinnate; leaflets 4–5 pairs, obcordate, smooth; flowers small, calyx purple, corolla yellow, perfume of jonquil, racemes; fruit legume 2.5–4 Cm. (1–1½') long, flattish, both ends tapering, 2-seeded. HEARTWOOD, in logs 1 M. (3°) long, 15 Cm. (6') or more thick, heavy, sp. gr. 1.06;

hard, purplish-black, internally brownish-red, marked with irregular concentric circles, medullary rays 4 cells wide, splitting irregularly; odor faint, agreeable; taste sweetish, astringent; when chewed colors saliva dark pink. In shops as small chips and coarse powder, dark brownish-red color, often with a greenish lustre (hæmatein), which pieces should be rejected. *Test*: 1. To slightly acidified water imparts yellowish color, changed to purple or violet-red by alkalis; if Brazil wood red, if red saunders no change. *Solvents*: boiling water; alcohol. Dose, 3ss–1 (2–4 Gm.).

FIG. 189.

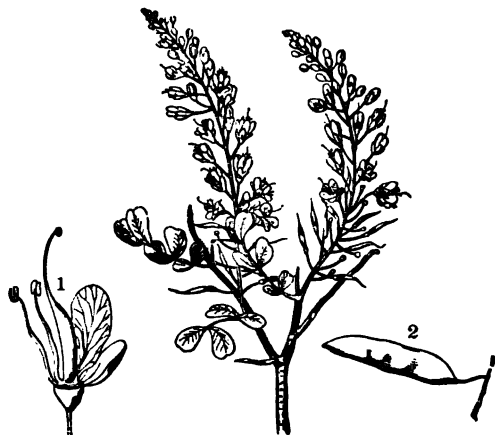
*Hæmatoxylon campechianum*: 1, flower; 2, fruit.

FIG. 190.

*Lignum campechianum*: cross-section, magnified 4 diam.

*Commercial*.—Trees, growing mostly on the shores of Campeachy Bay, are felled when 10 years old, deprived of bark and sapwood (alburnum), leaving the heartwood (duramen) to be cut into logs and alone sent into market. We have four varieties according to habitat: 1, *Campeachy*; 2, *Honduras*; 3, *St. Domingo*; 4, *Jamaica*—named in order of value. The tree, by cultivation, will grow in our Southern States, but there rarely flowers. The chips when old, from exposure of surface to atmosphere (having trace of ammonia), become more or less coated with a greenish substance, hæmatein, into which hæmatoxylin has oxidized by parting with two atoms of hydrogen, consequently fresh and old chips yield different coloring constituents.

*CONSTITUENTS*.—Hæmatoxylin, Volatile oil, Tannin, fat, resin.

**Hæmatoxylin** (*hæmatin*),  $C_{16}H_{14}O_6$ .—Is obtained by mixing powdered extract with sand, exhausting with ether; recover ether, add water, crystallize—adding a little sulphurous acid or a sulphite, to prevent oxidation; yield 12 p. c. It is pale yellow, sweet like licorice, soluble in alcohol and water, reddened by sunlight, yields pyrogallol when fused with potassium hydroxide, by fermentation get hæmatein,  $C_{16}H_{12}O_6$ , or blackish ammonia solutions, containing hæmatein-ammonia, upon adding acetic acid separates it, which may be reconverted

## CÆSALPINACEÆ.

into hæmatoxylin by hydrogen or sulphurous acid. The extract contains both hæmatoxylin and hæmatein; should avoid iron vessels in all manipulations.

PREPARATIONS.—1. *Extractum Hæmatoxyli*. Extract of Hæmatoxylon. (Syn., Extract of Logwood, *Extractum Ligni Campechiani*; Fr. *Extrait de Bois de Campêche*; Ger. *Campecheholzextrakt*.)

*Manufacture*: Macerate 10 Gm. with water 100 Cc., 48 hours, boil to 50, strain, evaporate to dryness; yield 12 p. c. Dose, gr. 5–15 (.3–1 Gm.).

*Unoff. Preps.*: *Decoctum Hæmatoxyli* (Br.), 5 p. c. + cinnamon 0.8 p. c., dose, 3j–2 (30–60 Cc.). *Fluidextract*, dose, Mx–60 (.6–4 Cc.).

PROPERTIES.—Similar to tannin, astringent, tonic, antiseptic. Darkens feces, makes urine sweet and blood-red; constipates less than pure astringents.

USES.—Cholera infantum, chronic diarrhœa, leucorrhœa, dysentery, dyspepsia, hemorrhage; may cause phlebitis. Antiseptic in gangrenous sores, indolent ulcers, cancer. Mainly used in dyeing violet, blue, gray, and black colors, giving to the latter a lustre and velvety appearance.

*Allied Plants*:

1. *Erythrophlœ'um guineen'se*, *Sassy*, *Mancona*, or *Ordeal Bark*.—The dried bark; W. and C. Africa. Large tree with spreading branches, doubly pinnated leaves. Bark flat or curved, 5 Mm. ( $\frac{1}{5}$ ') thick, warty, fissured, hard, dull red with whitish spots, brittle, transverse cut shows fawn-colored spots, inodorous, astringent; contains erythrophlœine (heart tonic, anæsthetic, poisonous), manconine, tannin. Cardiac tonic, local anæsthetic, astringent, diaphoretic, narcotic, sternutatory; occasions slow, strong pulse. Dose of erythrophlœine hydrochloride, gr.  $\frac{1}{32}$ – $\frac{1}{16}$  (.002–.004 Gm.).

## COPAIBA. COPAIBA.

*Copaiba*, *Miller*, } An oleoresin.  
one or more species. }

*Habitat*. Brazil (Venezuela, Colombia), Amazon valley, banks of the Orinoco River.

*Syn.* Balsam of Copaiba, Balsam Capivi; Fr. Copahu, Oleo-résine (Baume) de Copahu; Ger. Balsamum Copaivæ, Copaiva-balsam.

*Co-pai'ba*. L., Sp., and Port., fr. Brazil. *cupauba*—i. e., native name of the tree and its product.

PLANT.—Small tree, although sometimes 18 M. (60°) high, much branched, bark brown, rather smooth; leaves alternate, paripinnate; leaflets opposite, 3–5 pairs, 2.5–5 Cm. (1–2') long, ovate, entire, glabrous, coriaceous, pellucid-punctate; flowers small, white; sepals 5; apetalous; stamens 10; pod small, 2.5 Cm. (1') long, orange-brown, dehiscent into 2 valves, 1-seeded. OLEORESIN (copaiba), pale yellow to brownish-yellow, more or less transparent, viscid liquid, sometimes fluorescent, peculiar, aromatic odor, persistent, bitter, acrid taste, sp. gr. 0.950–0.995, soluble in chloroform, ether, alcohol, carbon

disulphide, petroleum benzin, fixed and volatile oils, insoluble in water.

*Tests:* 1. When heated on water-bath should not evolve odor of turpentine, and after 48 hours should have resinous mass weighing 50 p. c. of the original. 2. 1 Gm. dissolved in 50 Cc. alcohol should require 2.3–2.8 Cc.  $\frac{N}{2}$  alcoholic potassium hydroxide for neutralization, using 1 Cc. of phenolphthalein T. S. indicator (pres. of normal acid resin). 3. 4 drops poured upon 1 Cc. glacial acetic acid + 4 drops nitric acid should give no reddish zone, nor red or purple liquid upon shak-

FIG. 191.

*Copaiba Langsdorffii*

ing (abs. of gurjun balsam). 4. 5 Cc. shaken with 15 Cc. alcohol, boiled 1 minute, should give no drops of oil upon cooling and standing (abs. of paraffin oils). 5. 20 drops boiled 2 minutes with 1 Cc. alcoholic potassium hydroxide (1 in 10), upon cooling add twice volume of ether, no gelatinization should occur (abs. of fixed oils). 6. 1 Gm. shaken with 10 Cc. ammonia water, let stand 24 hours, liquid becomes turbid, but should not gelatinize or form firm mass (lim. of resin). Dose, m $\times$ –60 (.6–4 Cc.).

## CÆSALPINACEÆ.

**ADULTERATIONS.**—**OLEORESIN**: Those of allied species, that partially deprived of oil, oil of turpentine and other volatile oils, rosin, rosin oil, linseed oil, castor oil, other fixed oils, Venice turpentine, gurjun balsam, paraffin, alcohol; **OIL**: Gurjun balsam oil, increasing specific gravity, African copaiba oil, insoluble in equal volume alcohol.

**Commercial.**—During 1625 and 1638 considerable was written concerning copaiba, but in 1648 Marcgrav and Piso first described its collection, also the tree; Jacquin studied the genus in 1760, as did Desfontaines some years later; while in 1827 Hayne, and in 1870 Benthham separated, in Brazil alone, 11 species by their varying foliage, all having similar flowers and fruit. Nearly all the oleoresin, however, is from 7 species, viz.: Brazil—*C. Langsdorffii*, *C. confertiflora*, *C. coriacea*, *C. oblongifolia*; N. W. Orinoco Valley—*C. officinalis*; Amazonian region—*C. guianensis*, *C. multijuga*.

**Collection.**—Copaiba is a pathogenic product, doubtless as an antiseptic protection, and collects in ducts, being obtained by making large auger holes or boxes (square or wedge-shaped) into the centre of the tree's stem, near the base, from which it usually flows at once, giving 12 pounds (5.5 Kg.) in 3 hours; if none should appear, the wound is closed with clay or wax and reopened in 2 weeks, whereupon, as a rule, it discharges abundantly. Old trees may furnish 2–3 flows yearly, and when abandoned, these ducts, sometimes the length of the stem, occasionally fill, and thus acting as high liquid columns, furnish sufficient pressure to burst the trunk with a cannon-like report. The first flow is thin, clear, colorless, which shortly becomes thicker and yellowish; it also thickens by age. A tree may yield 10–12 gallons (38–45 L.), the value of which depends upon the amount of contained volatile oil. There are several commercial varieties:

1. *Para*.—The most limpid and pale colored; contains volatile oil 60–90 p. c.

2. *Maranhã*.—Odor slightly different, somewhat denser, having consistence of olive oil; contains volatile oil 40–60 (rarely 80) p. c.

3. *Rio Janeiro*.—Resembles very closely the Maranhã. These three (Brazilian) form clear mixtures with one-third to one-half their weight of ammonia water, but milky if more alkali or fixed oil present.

4. *Surinam*.—Rather thin, light yellow, soluble in ether, chloroform, 4–5 parts alcohol; it is from *C. guianensis*; and contains volatile oil 70–80 p. c.

5. *Maracaibo*.—This is the thickest, being dark yellow and turbid; contains volatile oil 20–40 p. c.; solidifies with magnesium oxide, not clear with ammonia water. Owing to large amount of resin, this variety is adapted for making the once official massa copaibæ, as it combines with magnesium oxide, forming resin soap, which gradually becomes dry and hard; can use Para and other varieties for same purpose, provided sufficient volatile oil be evaporated to render residue viscid upon cooling. Copaiba is exported not only from the above ports, but also from Angostura, Cayenne, W. Indies, in casks, demijohns, cans, jugs, etc.

**CONSTITUENTS.**—Volatile oil, Resin, bitter principle, copaivic acid,



$C_{20}H_{32}O_2$  (oxycopaivic acid,  $C_{20}H_{28}O_3$ , from Para; Metacopaivic acid,  $C_{22}H_{34}O_4$ , from Maracaibo; all three acids crystalline). Has no benzoic or cinnamic acid, hence the name balsam is misapplied.

**Oleum Copaibæ.** Oil of Copaiba,  $C_{15}H_{24}$ , official.—(Syn., Fr. Essence de Copahu; Ger. Copaivaöl.) This volatile oil is distilled from copaiba with water or steam, and upon it most of the medicinal properties of the oleoresin depend. It is a pale yellowish liquid, oxidizing by exposure, characteristic odor of copaiba, aromatic, bitter, pungent taste; consists chiefly of caryophyllene,  $C_{15}H_{24}$ ; sp. gr. 0.900, increasing with age; soluble in 2 volumes alcohol; that from Maracaibo dark blue with hydrochloric acid gas. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathcal{M}$ v-15 (.3-1 Cc.), in emulsion, capsule, or on sugar.

**Resina Copaibæ.** Resin of Copaiba, official.—(Syn., Acidum Copaibicum; Fr. Acide copahuvique; Ger. Copaiväsäure.) The residue left after distilling off the volatile oil from copaiba. It is brownish-yellow, brittle, slight odor and taste of copaiba, to which the resin returns when mixed with the volatile oil of copaiba; soluble in alcohol, ether, chloroform, benzene, volatile oils; contains copaivic, or metacopaivic acid, mixed with neutral resin. Dose, gr. 5-15 (.3-1 Gm.).

**PREPARATIONS.**—(Unoff.) *Massa Copaibæ*, 94 p. c. + magnesium oxide 6 p. c. *Emulsion.* *Electuary.* *Pills.* *Suppositories.* *Capsules.*

**PROPERTIES.**—Similar to turpentine; diuretic, stimulant, expectorant, laxative, nauseant, disinfectant; acts mainly on the mucous membranes (genito-urinary), by which, and also skin, it is eliminated; increases quantity as well as solids of the urine, and imparts odor to urine, sweat, milk, breath; sometimes erupts the skin—roseola, urticaria, etc.

**USES.**—Gonorrhœa, cystitis, bronchitis, dysentery, diarrhœa, hemorrhoids, psoriasis, dropsy, leprosy. Volatile oil is not so valuable for gonorrhœa, gleet, etc., as the oleoresin, but better for throat affections. Externally—chilblains, sore nipples, anal fissures, often added to varnishes and *vice versa*. Long usage may cause indigestion and renal irritation.

*Poisoning, Incompatibles, Synergists:* Same as for turpentine.

*Allied Plants:*

1. *Copaiba Martii*, *C. cordifolia*, *C. Jusseui*, *C. Jacquinii*, *C. nitida*. All furnish oleoresin, usually poor in the amount of volatile oil.

2. *Hardwickia pinna'ta*.—E. India. Tree yields dark brown oleoresin, containing volatile oil 20-40 p. c., resin, no copaivic acid.

3. *Dipterocarpus alatus*.—India. Tree yields gurjun balsam or wood oil—an oleoresin resembling copaiba, containing gurjunic (metacopaivic) acid.

4. *Copal, Gum Copal*.—A fossil resin of Zanzibar or exuding from many leguminous plants of Africa, S. America, W. Indies. Occurs in yellowish-brown masses, wrinkled surface, conchoidal fracture, glossy, odorless, tasteless. When melted becomes soluble in alcohol, ether, and oil of turpentine. Same medicinal properties as copaiba, only weaker. Used mainly in preparing varnishes.

KRAMERIACEÆ.

38. KRAMERIACEÆ. *Krameria* Family.

*Kra-me-ri-a'se-e.* L. *Krameri-a* + aceæ, in honor of Drs. J. G. H. and W. H. Kramer, German botanists, of the eighteenth century. Pubescent herbs, shrubs. Distinguished by leaves simple, exstipulate; flowers purplish, racemes, sepals large, 4–5, petals 4–5, smaller than sepals, stamens 3–4, monadelphous; ovary 1-celled, ovules 2; fruit spiny, indehiscent, 1-seeded; temperate climates, tropics; astringent, tonic, dye, ornament.

Genus: 1. *Krameria*.

KRAMERIA. KRAMERIA.

*Krameria* { *triandra*, Ruiz et Pavon,  
*Ixina*, Linné,  
*argentea*, Martius. } The dried root.

*Habitat.* 1. Peru, Bolivia. 2. Colombia, Mexico. 3. Brazil (in sandy localities of the mountains, elevation 925–2,465 M. (3,000–8,000°)).

*Syn.* Rhatany, W. India, Para or Savanilla Rhatany (*K. Ixina*); Br. *Krameriæ* Radix: Fr. Ratanhia; Ger. Radix Ratanhiæ, Ratanhiawurzel.

*Kra-me-ri-a.* L. see etymology, above, of *Krameriaceæ*.

*Tri-an'dra.* L. fr. Gr. *τρι*, three, + *άνδρῶς*, man, stamen—i. e., flowers have 3 stamens.

*Ix-i'na.* L. fr. native name *Ixine*, at Cumana, Venezuela, where Læfing discovered the plant in 1754.

*Ar-gen'te-a.* L. fr. *argenteus*, silvery, silvered—i. e., leaves whitish from adpressed silvery hairs.

*Rhat'a-ny.* Fr. Peruv. *ratana*, native name; Sp. *ratania*, *ratana*, creeping—i. e., the plant's habit.

**PLANTS.**—Low shrubs with spreading, decumbent branches; bark grayish-brown, when young hoary with erect silky hairs; leaves sessile, densely covered on both sides with adpressed silvery hairs, 12 Mm. ( $\frac{1}{2}$ ') long, obovate, entire; flowers Oct.–Nov., 18 Mm. ( $\frac{3}{8}$ ') broad, red; sepals 4, scarlet, in form of a cross; petals 4, dissimilar, red; fruit, size of a pea, 6 Mm. ( $\frac{1}{4}$ ') thick, covered with stiff, reddish-brown prickles, 1–2-seeded. Root (*Krameria triandra*), several branched from a short head, woody tap-root, 1.5–4 Cm. ( $\frac{3}{8}$ –1 $\frac{3}{8}$ ') thick, roughly fissured, supporting a knotty, several-many-headed crown, rootlets 25–50 Cm. (10–20') long, less than 1 Cm. ( $\frac{2}{5}$ ') thick; cylindrical, flexuous or wavy, flexible, light red-brown with dark, scaly patches upward, otherwise smoothish, devoid of transverse fissures, fracture tough, splintery, pinkish-brown bark less than one-third the radius, wood yellowish or pinkish-white, finely radiate; inodorous; very astringent taste; (*Krameria Ixina*, *K. argentea*), branches usually detached from tap-root and crown, less flexuous, purplish-brown or chocolate-brown, numerous transverse cracks or fissures, fracture less tough, bark and wood darker, bark two-fifths or more of radius, taste more astringent, thick; very astringent; inodorous; wood pale brownish-red, tough, with fine medullary rays, nearly tasteless, that of *K. Ixina* less knotty, more slender, with bark dark purplish-brown, 3 Mm. ( $\frac{1}{8}$ ') thick. *Solvents*: cold water; boiling water; alcohol. Dose, gr. 5–30 (.3–2 Gm.).

*Commercial.*—We have three important varieties :

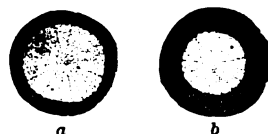
1. *Peruvian, Payta, Red Rhatany (K. triandra).*—Abundant around Huanuco and Lima, mainly shipped from Payta.

2. *Savanilla, New Granada, Antilles, Violet Rhatany (K. Ixina).*—This abounds in Colombia, Venezuela, Guiana, Brazil, Haiti, Antigua, Mexico. Of this species we have several varieties collected indiscriminately and so used : 1. Var. *granaten'sis* ; this is distinguished solely by its broader leaves. 2. Var. *tomento'sa* ; this is an extremely woolly form, and by some deemed deserving of specific rank (*K. tomentosa*), shipped not only from Savanilla, but also from Carthagena, Santa Marta, etc. ; for some years out of market, but now returning.

FIG. 192.

*Krameria triandra.*

FIG. 193.



*Krameria*: transverse sections: root; a, Peruvian; b, Savanilla.

3. *Para, Brazilian, Ceara, Brown Rhatany (K. argentea).* Although darker and less purple, it resembles *K. Ixina*, for which during the past few years it has largely been sold ; shipped chiefly from Para. Constituents are mostly in the bark, hence the thick-barked root, with little wood, is preferred. Roots are dug after rains, mostly in S. Peru, especially in Africa and Islay provinces.

**CONSTITUENTS.**—Kramero-tannic acid 20 p. c., Rhatanic-red, (starch, sugar, gum, wax, calcium oxalate).

**Kramero-tannic Acid** (*krameria* or *ratanhia-tannic acid*).—Obtained by treating ethereal extract of bark with alcohol and evaporating this latter solution. It is a red, amorphous powder, precipitated dark green by ferric salts and flesh-colored by gelatin ; no precipitate from tartar emetic, but fused with potassium hydroxide

**KRAMERIACEÆ.**

yields protocatechuic acid and phloroglucin; alcoholic tincture of Peruvian is reddish, Savanilla and Para yellowish, lead acetate with former gives reddish-brown, with two latter bluish-gray precipitate.

**Rhatanic-red** (*ratanhia-red*),  $C_{26}H_{22}O_{11}$ .—Obtained by boiling kramero-tannic acid with diluted sulphuric acid, when it splits into glucose and this coloring principle, which is similar to that found in horse-chestnut and tormentilla.

**PREPARATIONS.**—1. *Extractum Kramerie*. Extract of Krameria. (Syn., Extract of Rhatany; Fr. *Extrait de Ratanhia*; Ger. *Ratanhia-extrakt*.)

**Manufacture:** Percolate with water, heat liquid to boiling-point, strain, evaporate cautiously to dryness; yield 12–18 p. c. Dose, gr. 5–10 (.3–.6 Gm.).

**Prep.:** 1. *Trochisci Kramerie*. Troches of Krameria. (Syn., Fr. *Pastilles (Tablettes) de Ratanhia*; Ger. *Ratanhiapastillen*.)

**Manufacture:** Extract of krameria 6 Gm., sugar 65, tragacanth 2, stronger orange-flower water q. s. 100 troches. Dose, 1 troche occasionally.

2. *Fluidextractum Kramerie*. Fluidextract of Krameria. (Syn., *Extractum Kramerie Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Ratanhia*; Ger. *Flüssiges Ratanhiaextrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\nu$ –30 (.3–2 Cc.).

**Prep.:** 1. *Syrupus Kramerie*. Syrup of Krameria. (Syn., Fr. *Sirup de Ratanhia*; Ger. *Ratanhiasirup*.)

**Manufacture:** 45 p. c. Fluidextract of krameria 45 Cc., syrup 55 Cc. Dose, 3ss–4 (2–15 Cc.).

3. *Tinctura Kramerie*. Tincture of Krameria. (Syn., Fr. *Teinture de Ratanhia*; Ger. *Tinctura Ratanhiæ*, *Ratanhiatinktur*.)

**Manufacture:** 20 p. c. Macerate, percolate 20 Gm. with diluted alcohol q. s. 100 Cc. Dose, 3ss–2 (2–8 Cc.).

**Unoff. Preps.:** *Infusum Kramerie* (Br.), 5 p. c., dose, 3j–2 (30–60 Cc.). *Liquor Kramerie Concentratus* (Br.), 50 p. c., dose, 3ss–j (2–4 Cc.). *Trochiscus Kramerie et Cocainæ* (Br.), gr. 1 et  $\frac{1}{10}$  (.065 et .0032 Gm.).

**PROPERTIES.**—Similar to tannic acid, astringent, tonic.

**USES.**—Chronic diarrhoea, stomach and intestinal hemorrhage, leucorrhœa, dysentery, gleet, gonorrhœa, ozæna, menorrhagia, fissure of anus or nipple, incontinence of urine. Externally—gargle for sore throat, mucous membranes of eyes, nose, gums, epistaxis, rectal bleeding, relaxed uvula, tooth powder and wash. Generally used locally by injection, gargle, wash, enema (extract 2 p. c. in water).

**Allied Plants:**

1. *Krameria cistroides*.—Chile. Roots resemble Peruvian very closely, wood of tap-root pale-reddish in outer layer, brownish-red in the centre. *Guayaquil Rhatany* (origin unknown), root large, contorted, bark thin, fibrous, rich in tannin, reddish-brown, striated, warty.

2. *K. secundiflora* (*lanceolata*), *Texas Rhatany*.—Roots valuable, thin, dark brown, bark thick, rich in tannin; *Florida Rhatany*—same source, and similar to Texas; neither on the market.

### 39. PAPILIONACEÆ. Pea Family.

**Pa-pil-i-o-na'se-e.** *L. Papilion* + *aceæ*, butterfly—*i. e.*, alluding to the corolla being butterfly-shaped. Herbs, shrubs, vines, trees. Distinguished by leaves compound, stipulate; flowers papilionaceous, calyx 4–5-toothed, petals perigynous or hypogynous, upper one enclosing the lateral ones in the bud, stamens usually 10; pistil 1, ovary 1-celled; fruit legume or loment, 1-many-seeded; universal; astringent, antispasmodic, demulcent, sedative, dye, poisonous, timber.

Genera: 1. *Toluifera*. 2. *Astragalus*. 3. *Pterocarpus*. 4. *Glycyrrhiza*. 5. *Cytisus*. 6. *Vouacapoua* (*Andira*). 7. *Physostigma*.

### BALSAMUM PERUVIANUM. BALSAM OF PERU.

**Toluifera**  
**Pereiræ**, (*Royle*) *Baillon*. } A balsam.

*Habitat.* Central America (San Salvador), in woods near the coast.

*Syn.* Balsamum Peruvianum Nigrum, Balsamum Indicum, Black Balsam; Fr. Baume de Sansonate, (du Pérou, des Indes); Ger. Perubalsam, Indischen Balsam.

**To-lu-if'e-ra.** *L. tolu* + *fero, ferre*, to bear, producing tolu or an allied balsam—*i. e.*, it was brought first from Tolu, now Santiago de Tolu in U. S. Colombia.

**Per-ei'ræ.** *L. of Pereira*—*i. e.*, in memory of Jonathan Pereira (1804–1853), the author of *Elements of Materia Medica*, and Professor to the British Pharmaceutical Society, who visited S. America to study these and many other plants.

**PLANT.**—Handsome tree, 15–25 M. (50–80°) high, branching 2.5 M. (8°) above ground; leaves 6–10, alternate, 15–20 Cm. (6–8') long, imparipinnate; leaflets 5–7.5 Cm. (2–3') long, oblong-ovate, hairy, puckered margin; flowers 12 Mm. (½') long, whitish, tomentose, racemes; fruit 1-seeded legume 10 Cm. (4') long, yellowish-brown. **BALSAM** (of Peru), a pathologic product, thick, viscid, dark brown liquid, free from stringiness or stickiness, transparent reddish-brown in thin layers; agreeable vanilla-like odor; bitter, acrid taste, persistent after-taste, burning sensation to throat when swallowed; does not harden on exposure, sp. gr. 1.140, soluble in alcohol, chloroform, glacial acetic acid, partially in ether. *Tests*: 1. Triturate 10 drops + 20 drops sulphuric acid, get tough, homogeneous, brownish-red mass, which washed with cold water develops a violet color, leaving when drained a brittle resinous mass (abs. of fixed oils)—this resin should be perfectly soluble in ether (abs. of benzoin), and in alcohol or acetone (abs. of storax). 2. Dissolve 1 Gm. in 5 Cc. petroleum benzine; of this 2 Cc. + 1 drop nitric acid should not give green or bluish-green (abs. of rosin); 3 Cc. + 3 Cc. aqueous solution copper acetate (1 in 1,000) should not be green or bluish-green (abs. of rosin, turpentine, storax, fatty oils). 3. Heated with half-volume of calcium hydroxide should not form solid mass (abs. of rosin, storax, copaiba). *Assay*: Shake 3 Gm. + 30 Cc. sodium hydroxide T. S. + ether 60 Gm.,

## PAPILIONACEÆ.

of the ether-solution evaporate to dryness 51.5 Gm., which should weigh 1.4 Gm. (pres. 56 p. c. of cinnamein); the residue dissolved in 25 Cc. alcohol, + 25 Cc.  $\frac{N}{2}$  alcoholic potassium hydroxide V. S., heated, should require for neutralization 13.2 Cc.  $\frac{N}{2}$  hydrochloric acid V. S., using phenolphthalein T. S. indicator. Dose,  $\mathfrak{M}\nu$ —30 (.3–2 Cc.).

ADULTERATIONS.—Alcohol, fixed and volatile oils, castor oil, storax, gurjun balsam, copaiba, Canada turpentine, rosin, water.

Commercial.—Balsam of Peru was long considered to be from *Myroxylon peruiferum*, a Brazilian tree, whose product reached Europe via Peru (Callao), hence its name. This, however, is a distinct species flourishing in Ecuador, Peru, Brazil and yields a fragrant balsam resembling Tolu, called at Rio *Olea Vermelho*.

FIG. 194.

*Toluidfera pereira.*

Collection.—There seem to be no regular plantations, but the trees, either isolated or in groups, grow wild in forests—sometimes being found in apparent rows, suggesting original planting. They do not thrive above 300 M. (1,000°) elevation, and begin yielding balsam when 5 years old, continuing for 30 or more thereafter. The aroma

of the flowers may readily be perceived at a distance of several hundred feet, and the aborigines collect the balsam in a district reserved to them, called Sonsonate or Balsam Coast, extending from Acajutla to Port Libertad. The balsam owes its qualities to neither wood nor bark, but to the special treatment which the trees receive. During April-Dec., at various places on the trunk and stout branches, the outer cortical portion is scraped off an eighth of an inch deep and twelve inches square; these scarified places are heated with burning torches until about half charred, when raw cotton or pieces of old cloth are caused to adhere by punching with a machete, where they remain one or two days until saturated, then are collected, boiled in large iron pots, liberating most of the balsam, and finally squeezed in a primitive machine, the product being caught in large bladders, gourds, or wooden bowls, giving when cool "raw balsam," which may be refined on the spot by a second boiling and straining, or sent to the towns for further purification, where it may be put into screw-top canisters of about 60 pounds (27 Kg.) capacity. If the process be conducted carefully the lower wounds will heal while fresh ones are being worked above; usually some flow occurs as long as the wounds are kept open. When trees are tapped for six consecutive seasons, an interval of two or three years generally is allowed, which renders the product more abundant and satisfactory, while a rest of five or six years in every twenty assures a continued yield. Each tree yields 2-5 pounds (1-2.5 Kg.) annually. In addition to this balsam, the fruit by expression yields a white semi-fluid balsam (*Balsamo blanco*) which somewhat resembles Tolu Balsam, but is an entirely distinct substance, having an aromatic odor approximating that of Tonka, yet unlike either balsam of Tolu or Peru; contains a crystalline resin, *myroxocarpin*. The tree exudes also a gumresin which contains 77.4 p. c. resin, but no aromatic principle or cinnamic acid. The natives prepare a tincture from the fruit with rum, called *balsamito*; it is a stimulant, anthelmintic, diuretic, and used externally for indolent ulcers, freckles, etc. Balsam of Peru is exported from Acajutla (Pacific coast) and Balize (Atlantic coast) in jars, tin canisters, or metallic drums.

**CONSTITUENTS.**—Benzoic acid-benzyl ester, Cinnamein (volatile oil) 56-66 p. c., Resin 16-25 p. c., Cinnamic and Benzoic acids 23 p. c., Vanillin.

**Benzoic acid-benzyl ester.**—The chief active constituent is a colorless oily liquid, boiling at 173° C. (344° F.), congealing at 32° C. (90° F.), and may readily be made synthetically.

**Cinnamein.**—Consists largely of benzoic acid-benzyl ester, and to a small extent of cinnamic acid-benzyl ester; these two esters may readily be separated by fractional distillation in vacuo, and thus obtained pure possess the characteristics, chemical and therapeutic, of the synthetic esters; the cinnamic acid-benzyl ester boils at 213° C. (416° F.) and congeals at 37° C. (99° F.).

**Resin.**—Consists of peru-resinotannol combined with benzoic and cinnamic acids; soluble in caustic alkali, and when in solution precipi-

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tated by carbon dioxide; insoluble in carbon disulphide; on dry distillation yields benzoic acid, styrol, and toluol,  $C_7H_8$ .

PREPARATIONS.—(Unoff.) *Syrup. Mistura Oleoso Balsamica* (ner-vine). *Emulsion. Alcoholic Solution. Ointment. Capsules.*

PROPERTIES.—Stimulant, expectorant, disinfectant, vulnerary, stomachic. It is eliminated by bronchial mucous membrane, kidneys, and skin, stimulating and disinfecting their secretions.

USES.—Chronic catarrh, asthma, phthisis, gonorrhœa, amenorrhœa, rheumatism, palsy; externally on indolent ulcers, scabies, ringworm, tonsillar diphtheria, bronchitis, tuberculosis of the skin, bone, or larynx, chilblains, eczema, for masking the odor of iodoform in ointment.

## BALSAMUM TOLUTANUM. BALSAM OF TOLU.

*Tolulifera*  
*Balsamum*, Linné. } A balsam.

*Habitat.* S. America (Venezuela, Colombia, Peru); high rolling countries.

*Syn.* Fr. Baume (de Carthagène) de Tolu; Ger. Tolubalsam.

*Bal'sa-mum.* L. fr. Gr. *βάλσαμον*, for balsam, name of balsam tree, from its characteristic secretion.

PLANT.—Evergreen tree 24 M. ( $80^{\circ}$ ) high, often branchless for 15 M. ( $50^{\circ}$ ) above ground, spreading head; bark smooth, yellowish-brown, with numerous white lenticels, differs from *T. Pereira* in having leaves shorter, leaflets smaller, fewer, 4–7, recurved, margin not puckered, nor rachis or petioles hairy, glands less prominent, flowers and fruit similar. BALSAM (of Tolu), a pathologic product, yellowish-brown, plastic solid, becoming brittle when old, dried, or exposed to cold, transparent in thin layers, pleasant, aromatic odor, vanilla-like, mild, aromatic taste, soluble in alcohol, chloroform, solutions of fixed alkalis, nearly so in ether, but almost insoluble in water, petroleum benzin, carbon disulphide; this latter, when hot, removes only cinnamic and benzoic acids, which solution upon evaporation should leave no resinous substance; microscope reveals cinnamic acid crystals. *Tests*: 1. Shake 0.5 Gm. + 25 Cc. carbon disulphide, let stand, evaporate filtrate to dryness, dissolve residue in glacial acetic acid; this should not give green color with few drops of sulphuric acid (abs. of rosin). 2. Shake 1 Gm. + 8 Cc. petroleum benzin; the supernatant liquid should not be green when shaken with equal volume of aqueous solution copper acetate (1 in 1,000) (abs. of rosin, copaiba). Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Turpentine (blackish instead of cherry-red with sulphuric acid, soluble in carbon disulphide), sweet gum (yields styracin to hot benzin, crystallizing when cold), storax, rosin, copaiba, saponifiable substances, various other resins. A factitious balsam has been found containing storax 63 p. c.

*Commercial.*—The collection is effected by making V-shaped incisions through the bark; below each the wood is hollowed out to receive a calabash cup the size of a teacup, into which the balsam flows. Often so



many as 20–30 incisions are cut, which extend from ground upward 2.5–3 M. (8–10°), the higher ones being made with the aid of ladders or scaffolds. As occasion demands, gatherers empty the cups into raw-

FIG. 195.



*Toluifera Balsamum*: twig one-third natural size, with fruit.

hide, flask-shaped bags (carried by donkeys) which, when filled, are sent to ports along the Magdalena and Orinoco Rivers, in Venezuela; there the balsam is transferred to cylindrical tins (10–25 pounds; 4.5–11.5 Kg.), formerly calabashes or baked earthen jars, and as such enters commerce via Carthagena. The bleeding continues July to April at the rate of filling the cups during “each moon.”

**CONSTITUENTS.**—Resin 75–80 p. c., Cinnamic and Benzoic acids 18–20 p. c., Volatile oil 1 p. c., benzylic cinnamate, benzylic benzoate, and vanillin 0.5 p. c., the last three forming an acid, aromatic oily liquid 7.5 p. c.

**Resin,  $C_{18}H_{20}O_5$ .**—Chief constituent, consisting of tolu-resinotannol combined with benzoic and cinnamic acids; it is amorphous, black, brittle, similar to that of *T. Pereiræ*, having a portion soluble in carbon disulphide, which upon evaporation yields a crystalline, nearly

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colorless residue about 25 p. c. of the balsam; a portion of the resin is sparingly, and another readily, soluble in alcohol.

**Volatile Oil.**—Obtained by distilling with water; chiefly tolene,  $C_{10}H_{16}$ , hardening by exposure, odor pleasant, sp. gr. 0.858.

**Acids.**—Obtained by distillation—benzoic, cinnamic, with benzylic ethers of both, the benzyl cinnamate predominating. Trommsdorf found resin 88 p. c., volatile oil 0.2 p. c., cinnamic acid 12 p. c., this latter coming over as a heavy oil condensing into white crystalline mass. Dry distillation gives the above acids and ethers, also styrol, phenol, toluol—this latter being found in coal tar, wood tar, organic compounds, balsams (Peru, etc.) and resins; it is a colorless, oily liquid, readily convertible into benzoic acid.

**PREPARATIONS.**—1. *Tinctura Tolutana*. Tincture of Tolu. (Syn., Fr. Teinture de Baume de Tolu; Ger. Tolubalsamtinktur.)

**Manufacture:** Macerate until dissolved, frequently agitating, 20 Gm. with alcohol q. s. 100 Cc., filter. Dose, ℥x–30 (.6–2 Cc.).

**Prep.:** 1. *Syrupus Tolutanus*. Syrup of Tolu. (Syn., Fr. Sirop (balsamique)—de Baume de Tolu; Ger. Tolubalsamsirup.)

**Manufacture:** Rub tincture of tolu 5 Cc. with magnesium carbonate 1 Gm., sugar 6, gradually add water 45 Cc., with constant trituration, filter; dissolve sugar 76 Gm. in clear filtrate by heat, strain, add water q. s. 100 Cc. Dose, ʒj–4 (4–15 Cc.).

2. *Tinctura Benzoini Composita*, 4 p. c.

**Unoff. Preps.:** *Emulsion*. *Lozenges*. *Inhalations*.

**PROPERTIES.**—Stimulant, expectorant, disinfectant, vulnerary, stomachic.

**USES.**—Much less decided than balsam of Peru, but similar, bronchial affections, diphtheritic deposits, catarrhs, coughs, flavoring, perfumery.

**Incompatibles:** Water and aqueous preparations with the tincture.

**Synergists:** Balsams, aromatic drugs, volatile oils, stimulant expectorants.

**Allied Plants:**

1. *Myroxylon punctatum*.—The *Quino-quino* tree, and *M. peruvianum*, both of Peru; yield balsams resembling official Peru and Tolu.

## TRAGACANTHA. TRAGACANTH.

*Astragalus gummifer*, Labillardière, } A gummy exudation.  
and other species.

**Habitat.** W. Asia.

**Syn.** Goat's Thorn, Doctor's or Hog Gum; Fr. Gomme Adragant(e); Ger. Traganth.

**As-trag'a-lus.** L. fr. Gr. *δοτέον*, bone, + *γάλα*, milk—i. e., the milky then horny exudation, or from the seed squeezed into a squarish form like vertebrae (*αστράγαλος*) in some species.

**Gum'mif-er.** L. *gummi*, gum, + *ferre*, to bear—i. e., plant produces gum.

**Trag-a-can'tha.** L. fr. Gr. *τράγος*, a goat, + *ἀκανθα*, thorn—a goat thorn—i. e., plant thorny like goat's head, and hedges made of it resist their onslaughts.

PLANT.—Shrub .6–1 M. ( $2-3^{\circ}$ ) high ; stem naked with many straggling, much ramified branches ; bark reddish-gray, rough, and marked

FIG. 196.

*Astragalus gummifer* (natural size of branch).

with leaf-scars, young twigs woolly ; leaves 3 Cm. ( $1\frac{1}{2}'$ ) long, closely placed, pinnate, rachis hard, stiff, persistent for some years as a woody spine, yellow, very sharp-pointed ; leaflets 10–15 pairs, 3 Mm. ( $\frac{1}{8}'$ ) long, obovate, grayish-green ; flowers small, pale yellow ; stamens 10, upper one free, others united in a sheath ; fruit small, oblong pod, covered with white hairs ; seed 1, reniform, smooth, pale brown. GUM (tragacanth), in ribbon-shaped bands, varying size, 1–3 Mm. ( $\frac{1}{25}-\frac{1}{8}'$ ) thick, or irregular pieces, long linear, straight or spirally twisted, whitish, with longitudinal or concentric lines or ridges, translucent, horny, fracture short, tough, more easily powdered by heat of  $50^{\circ}$  C. ( $122^{\circ}$  F.). *Tests* : 1. With 50 parts of water swells gradually forming cloudy, gelatinous mass, which warmed with solution sodium hydroxide becomes yellow and tinged blue with iodine T. S. ; fluid portion is precipitated by alcohol, but not colored blue by iodine T. S. *Solvents* : hot or cold water best. Dose, gr. 5–30 (.3–2 Gm.).

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**ADULTERATIONS.**—1. *Cherry Gum* (cherry, almond, plum, etc.), in irregular brownish nodules, insoluble portion not identical with bassorin. 2. *Bassora* or *Kutera Gum*. Persia. This is broken up in Smyrna and mixed with tragacanth; occurs in yellowish-brown (sometimes whitened with lead carbonate), tasteless masses, swelling with water. 3. *Cashew Gum*, brownish-yellow, translucent, iridescent, partly soluble in water.

**Commercial.**—The many *Astragalus* species are native of mountainous districts of Asia Minor, Armenia, Kurdistan, Persia, Syria, Greece. This gum is not a simple plant juice, but the cells of the pith and medullary rays of the stem undergo transformation into this mucilaginous mass—degenerative product. It exudes spontaneously either through natural or artificial punctures, transverse incisions, etc., produced into stem and older branches. The incisions are made July–August near the ground, and their shape, together with the rate of flow, determines its hardened outline, while time elapsing before sufficiently hard for collection (dry weather 3–4 days) governs its color; white if congealed rapidly, yellow to brown if slowly, due to long exposure to changeable weather—the whiter and more translucent always being of greatest value. Enters commerce via Smyrna (Constantinople, Bagdad, and the Persian Gulf), where it is garbled into three varieties:

1. *Flake Tragacanth* or *Leaf Gum*.—Sometimes called Smyrna; usually in broad, thick, and yellowish flakes, prominently ridged; the ribbon-like and white flakes are produced in Kurdistan and Persia, often being designated as Syrian tragacanth.

2. *Vermiform Tragacanth* or *Vermicelli*.—In very narrow, contorted, string like pieces or coils, these latter being mostly confluent.

3. *Common Tragacanth* or *Sorts*.—Known in Europe as *traganton*, results from spontaneous exudation, being incidentally collected while gathering higher grades; occurs in tear-like pieces, rounded or irregular, brownish, waxy, and, like the preceding varieties, encloses starch.

**CONSTITUENTS.**—Cellulose, Soluble gum, Bassorin, Polyarabinan-brigatactan-geddic acids, Starch, nitrogenous matter,  $\alpha$ -tragacanthan-xylan-bassoric acid, xylan-bassoric acid, bassoric acid,  $\beta$ -tragacanthan-xylan-bassoric acid.

**Cellulose.**—The portion of gum insoluble in boiling water, in cold diluted acids and alkalies; when treated with boiling diluted sulphuric acid yields arabinose, and a cellulosic residue which is soluble in ammonia and bromine.

**Soluble Gum.**—This yields a series of gum acids having the nature of the “geddic acids,” but are levogyrate, whereas geddic acids are dextrogyrate.

**Bassorin.**—This is an acid which yields a barium salt and two isomeric acids— $\alpha$ - and  $\beta$ -tragacanthan-xylan-bassoric acid when acted upon by excess of an alkali; the former is soluble in cold water and yields sparingly soluble salts of barium, calcium, and silver; when digested with diluted sulphuric acid yields tragacanthose and xylan-

bassoric acid, and when this acid is acted on further by 5 p. c. sulphuric acid, it yields xylan and bassoric acid.

PREPARATIONS.—1. *Mucilago Tragacanthæ*. Mucilage of Tragacanth. (Syn., Fr. Mucilage Adragant; Ger. Traganthschleim.)

*Manufacture*: 6 p. c. Heat glycerin 18 Gm. + water 75 Cc., add tragacanth 6 Gm., macerate 24 hours, add water q. s. 100 Gm., beat until uniform, strain. Dose, ʒj–2 (30–60 Cc.).

Prep.: 1. *Trochisci Sodii Bicarbonatis*, q. s.

2. *Emulsum Chloroformi*, 1 p. c. 3. *Pilulæ Ferri Carbonatis*,  $\frac{1}{4}$  gr. (.01 Gm.). 4. *Trochisci Acidi Tannici*,  $\frac{1}{3}$  gr. (.02 Gm.). 5. *Trochisci Ammonii Chloridi*,  $\frac{1}{3}$  gr. (.02 Gm.). 6. *Trochisci Gambir*,  $\frac{1}{3}$  gr. (.02 Gm.). 7. *Trochisci Kramerizæ*,  $\frac{1}{3}$  gr. (.02 Gm.). 8. *Trochisci Potassii Chloratis*,  $\frac{1}{2}$  gr. (.03 Gm.). 9. *Trochisci Santonini*,  $\frac{1}{2}$  gr. (.03 Gm.).

PROPERTIES.—Demulcent, emollient, protective, nutritious.

USES.—Was not known to the Greeks until fourth–fifth century, when its uses were as now, for cough, hoarseness, expectorant, similarly as acacia; its superior adhesiveness over the latter renders it a better protective in excoriated surfaces, ulcers, burns, etc. Employed largely for suspending resins, oils, heavy powders, etc., in emulsion. Also to cohere pills, troches, etc.; its partial insolubility in the stomach restricts somewhat its use.

*Allied Plants*:

1. *Astragalus bæ'ticus*.—Mediterranean basin; seeds used for coffee. *A. exsca'pus*. C. and S. Europe, mountains; root mucilaginous, astringent, bitter, diuretic. *A. glycyphyl'los*. Europe; leaves and seed sweetish, diuretic.

2. *A. crotala'ria*, *Loco Weed*, *Rattle Weed*, and *A. mollis'simus*.—N. America (Cal., Neb., Tex.); poisonous to cattle, horses, etc., causing spinal tetanic action.

## SANTALUM RUBRUM. RED SAUNDERS.

**Pterocarpus**  
**santalinus**, Linné filius. } The heartwood.

*Habitat*. Madras; cultivated in S. India, Ceylon, Philippines.

*Syn*. Br. Pterocarpi Lignum, Red Saunders (Sandal) Wood. Red Santal, Chandam, Chundana, Ruby Wood; Fr. Santal Rouge; Ger. Rother Santelholz.

**Pter-o-car'pus**. L. from Gr. πτερόν, wing, + καρπός, fruit—i. e., its winged fruit pods or legumes girdled with a broad crisped wing.

**San-ta-li'nus**. L. adj. form fr. sandal, Pers. sandal, useful; Gr. σάνταλον.

**San'ta-lum**. L. noun form; sandalwood, saunders.

**Ru'brum**. L. ruber, red, ruddy—i. e., the color of the wood.

PLANT.—Tree 6–9 M. (20–30°) high, .3–.5 M. (12–18') thick, some trunks hollow; leaves trifoliate; leaflets broadly oval, emarginate, 5–15 Cm. (2–6') long, hoary beneath; flowers yellow, papilionaceous corolla, spikes; fruit orbicular legume, wing slightly crisped, 2-seeded. WOOD, in billets, logs 1–1.6 M. (3–5°) long, 10–20 Cm. (4–8') thick, deprived of light-colored sapwood, hard, heavy, dark reddish-brown, splitting coarse-splintery; usually met with in chips,

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or irregularly coarse, brownish-red powder; in transverse section slightly radiate, with many concentric rings, the medullary rays 1 cell in width; nearly inodorous and tasteless; does not redden water upon maceration. *Solvents*: alcohol, ether; acetic acid; alkaline solutions; boiling water and diluted alcohol partially.

**PREPARATION.**—1. *Tinctura Lavandulæ Composita*, 1 p. c.

**CONSTITUENTS.**—Santalin 0.25–0.5 p. c., Santal, Pterocarpin, Homopterocarpin.

**Santalin**, (*santalic acid*),  $C_{15}H_{14}O_5$ .—Coloring-matter, obtained by precipitating alcoholic tincture with lead acetate; wash precipitate with hot alcohol, decompose it with hydrogen sulphide in the presence of alcohol, evaporate, getting red needles, inodorous, tasteless, resinous; soluble in alcohol with a blood-red color, in ether yellow, in sulphuric acid deep red, and in alkalis violet; soluble in oils of cloves, cinnamon, bergamot, bitter-almond.

**Santal**,  $C_8H_8O_3$ , **Pterocarpin**,  $C_{20}H_{18}O_6$ , **Homopterocarpin**,  $C_{24}H_{24}O_6$ .—All occur in colorless scales, the latter is soluble in carbon disulphide and when fused with potassium hydroxide yields phloroglucin.

**USES.**—Red Saunders has no important medicinal properties, being used only for imparting color. Employed natively as an astringent and with sapan wood for dyeing silk, cotton, wool, giving various colored reds according to mordants used.

*Allied Plant:*

1. *Ichthyome' thia Piscip' ula* (*Piscid' ia Erythri' na*), *Jamaica Dogwood*.—W. Indies. Well-developed tree, whose bark has long been used for catching fish, orange-yellow, fissured, tough, fibrous, odor opium-like, taste bitter, acrid. Narcotic, analgesic, soporific; neuralgia, nervous insomnia, whooping-cough, dysmenorrhœa; similar to opium, but devoid of unpleasant after-effects. Dose, ʒss–1 (2–4 Gm.), extract, fluidextract.

**KINO. KINO.**

**Pterocarpus**  
**Marsupium**, *Roxburgh.* } The inspissated juice.

*Habitat.* E. India, in forests; C. and S. India (Malabar), Ceylon, Bengal.

*Syn.* Gummi or Resina Kino, Vengay, Bastard Teak, Bija, Amboyna Kino Tree; Fr. Kino de l'Inde; Ger. Kino.

*Mar-su' pi-um.* L. *marsupium*, a pouch, bag, purse—i. e., shape of the fruit.

*Ki' no.* E. India name as given the extract.

**PLANT.**—Fine timber tree, called natively *Buja*, 18–24 M. (60–80°) high, .6–1 M. (2–3°) thick, many spreading branches; bark brownish-gray, internally red and fibrous; leaves alternate, imparipinnate, deciduous; leaflets 5–7, alternate, 5–10 Cm. (2–4') long, obovate, emarginate, coriaceous; flowers May–June, pale yellow; fruit an indehiscent pod, orbicular, 2.5–4 Cm. (1–1½') in diameter; seed 1, kidney-shaped. **JUICE** (kino), in small angular, dark brownish-red pieces, brittle, in thin layers ruby-red, transparent, non-crystalline, powder reddish; inodorous, astringent, sweetish, tingeing the saliva

deep red, adhering to the teeth, nearly insoluble in ether, slowly soluble in cold water; the hot water and diluted alcohol solutions gelatinize. *Solvents*: alcohol to the extent of 90 p. c.; boiling water to 80 p. c.; alkalies (with impairment of astringency). Dose, gr. 5–20 (.3–1.3 Gm.).

FIG. 197.



*Pterocarpus Marsupium* (Kino): A, flowering twig; 1, 2, 3, parts of the flower; 4, stamens; 5, pistil; 6, fruit; 7, vertical section of winged fruit.

**ADULTERATIONS.**—Inferior juices, catechu, etc.

*Commercial.*—The privilege of tapping trees is granted by the government to the highest bidder, and while this is done chiefly in the dry season (Feb.–March), yet the juice may be collected throughout the entire year. This is accomplished by cutting a perpendicular incision to the cambium in the tree-trunk, then lateral ones leading thereto; the juice, resembling currant-jelly, at once exudes, being caught in clay cups, bamboo-joints, etc., placed at the bottom of the main incision, and soon thereafter is either dried in the sun and air (inspissated) or boiled, during which the impurities are skimmed off; when the consistency of a thick extract it is poured into pans in thin layers, to dry until crumbly—half-inch layer requiring a week—then packed in wooden boxes for market. The juice runs best at night, and small trees are the better producers; may kill trees by excessive bleeding, which can be avoided by resting every other year; the yield from each is about 24 ounces (.7 Kg.), producing half as much kino. The menstruum considered to

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make most permanent solution is water 20, alcohol 65, glycerin 15 volumes, although alcohol 50, water 25, glycerin 25, gives satisfaction. As all liquid preparations tend to gelatinize and lose astringency, they should be kept in small bottles and seldom opened. We have several varieties. 1. *Malabar, E. India*, official kind described above, but rarely found on the market. 2. *African, Gambia (P. erina'ceus)*, similar to above—not in our market, but common in England as Kino; yields tannin 50–60 p. c. 3. *Bengal, Palas (Bu'tea frondo'sa)*, blackish-red, in transparent, light ruby-red tears or fragments often with leaf-vein impressions, brittle, not adhesive on mastication; does not contain pyrocatechin, but yields it on dry distillation; only one-third to one-half soluble in hot alcohol, the remainder being mucilaginous matter; yields tannin 15–35 p. c. 4. *Australian, Botany Bay (Eucalyptus rostra'ta, E. amygdalina, E. resinif'era*, and other species of Myrtaceæ), composition and solubility not uniform, as the amount of gum varies in different varieties, but it furnishes much of the present commercial kino; yields tannin 45–50 p. c. 5. *W. India, Jamaica, (uracac (Coccol'oba uvif'era, Polygonaceæ)*; obtained by boiling the violet-brown wood and bark of the large tree and evaporating the decoction; resembles official, but has brownish tint, less glossy, bitter taste, 90 p. c. soluble in water or alcohol; its tannin almost identical with that in the official.

**CONSTITUENTS.**—Kino-tannic acid,  $C_{18}H_{18}O_8$ , 40–80 p. c., Kino-red,  $C_{24}H_{22}O_{11}$ , Pyrocatechin (pyrocatechuic acid, catechol),  $C_6H_6O_2$ , Kinoin,  $C_{14}H_{12}O_6$ , gum, ash, 1.3 p. c.

**Kino-tannic Acid.**—Similar to catechuic acid, always mixed with coloring-matter and pectin in extraction; with ferric salts gives a greenish-black and with ferrous salts in neutral solutions a violet color.

**Kino-red.**—Obtained by exposing cold aqueous solution to the air, when red precipitate slowly forms, hastened by heating; or heat kinoin to  $130^{\circ} C.$  ( $266^{\circ} F.$ ); it is amorphous, tasteless, nearly insoluble in water, and is the anhydride of kinoin:  $2C_{14}H_{12}O_6 - H_2O = C_{28}H_{22}O_{11}$ .

**Pyrocatechin.**—Obtained by treating kino with ether, or the product of dry distillation of kino contains much of it, which may be purified by resublimation; soluble in ether, water.

**Kinoin.**—Boil kino with diluted hydrochloric acid, kino-red immediately separates; now agitate clear solution with ether; occurs in white crystals, slightly soluble in ether, cold water; red with ferric chloride.

**PREPARATIONS.**—1. *Tinctura Kino.* Tincture of Kino. (Syn., Fr. Teinture de Kino; Ger. Kinotinktur.)

**Manufacture:** 5 p. c. Mix glycerin 15 Cc. with water 20, triturate kino 5 Gm. + purified talc 1, with mixture q. s. smooth magma, weigh and heat this in flask 1 hour on water-bath with remainder of mixture, cool, restore original weight with water, add alcohol 65 Cc., filter, adding alcohol q. s. 100 Cc. Dose, 3ss–2 (2–8 Cc.).

**Unoff. Preps.:** *Infusion*, 5 p. c., dose, 3ss–1 (15–30 Cc.). *Pulvis Kino Compositus* (Br.), 75 p. c. (+ opium 5, cinnamon 20), dose, gr. 5–20 (.3–1.3 Gm.). *Eucalypti Gummi* (Br.), red exudation from *E.*



*rostra'ta*, dose, gr. 2-5 (.13-.3 Gm.). *Fluidextract*, dose, Mv-30 (.3-2 Cc.). *Gargles*.

Owing to gum (pectin) coagulating, the liquid preparations are very unstable; therefore catechu often is used in its stead with equally good results.

**PROPERTIES.**—Astringent, tonic, hæmostatic; similar to but less powerful than tannin. Locally inferior to other astringents.

**USES.**—Diarrhœa, pyrosis, menorrhagia, dysentery, leucorrhœa, ulcers, sore throat, manufacture of wines. Useful in dyeing and tanning, but rather too expensive.

*Incompatibles*: Aqueous solution is precipitated by gelatin, soluble salts of iron, silver, lead, antimony, mercuric chloride, sulphuric, nitric, and hydrochloric acids.

### GLYCYRRHIZA. GLYCYRRHIZA (LICORICE ROOT).

**Glycyrrhiza** { *glabra*, Linné, } The dried rhizome  
                  { *glandulifera*, Waldstein et Kittabel. } and root.

*Habitat*. S. Europe, W. Asia, Syria, Persia, N. Africa (cultivated in Russia, Spain, England, France, Germany, United States, China).

*Syn.* Liquorice Root, Sweet Wood, Italian Juice Root, or Wood, Spanish Juice Root. *Radix Glycyrrhizæ Hispanicæ*; Br. *Glycyrrhizæ Radix*; Fr. Bois doux, Racine douce, Réglisse, Bois de Réglisse; Ger. *Radix Liquiritiæ*, Süßholz, Spanisches Süßholz, Lakritzenholz.

**Glyc-yr-rhi'za**. L. fr. Gr. γλυκύριζα—γλυκός, sweet, + ρίζα, root—i. e., its saccharine taste (*Dioscorides*).

**Gla'bra**. L. *glaber*, smooth, hairless—i. e., pods, leaves smooth on both sides.

**Glan-du-lif'e-ra**. L. *glandula*, a gland, + *ferre*, to bear—i. e., pods covered with thick glandular spines.

*Lic'o-ri-ce*—*Liq'uo-ri-ce* (lik'o-ris). Fr. L. *liquiritia*, corruption of *glycyrrhiza*.

**PLANT.**—Perennial herb; stem .6-1.5 M. (2-5°) high, several from the (crown) thick rhizome; leaves imparipinnate; leaflets 4-7 pairs, ovate, entire, smooth, glutinous beneath, dark green; flowers yellowish-white or purplish, pulse-shaped, racemes; fruit legume, 2.5 Cm. (1') long, brown, ovate, flat, 1-celled, 1-6-(kidney-shaped) seeded: *G. glandulifera*—stem somewhat pubescent; leaves hairy, glandular beneath; legumes glandular, prickly. Root (*Glycyrrhiza glabra*), cylindrical, usually in pieces 14-20 Cm. (6-8') long, 5-15 Mm. ( $\frac{1}{5}$ - $\frac{3}{4}$ ') thick, grayish-brown or dark brown, longitudinally wrinkled, pliable, fracture coarsely fibrous, internally tawny yellow, bark  $\frac{1}{15}$ - $\frac{1}{8}$ ' thick, wood porous, in narrow wedges; odor slight; taste sweetish, slightly acid, mostly in the bark; (*Glycyrrhiza glandulifera*), somewhat tapering, 1 M. (3°) or more long, 1-5 Cm. ( $\frac{2}{3}$ -2') thick, deprived of outer corky layer (bark), when it is externally pale yellow, internally lighter yellow, wood soft; taste less sweet than preceding; any blackened, knotty, bitter portions should be removed before using; powder of both identical as to character and location of starch grains, crystals, numerous bast fibres, peculiar wood fibres and sieve-tissue. *Solvents*: water; diluted alcohol. Dose, gr. 15-60 (1-4 Gm.).

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*Commercial*.—We have two varieties :

1. *Spanish* (*Italian, Turkish, Alicante, Tortosa*); *G. glabra*.—This is the sweeter and the kind most generally used.

2. *Russian*; *G. glandulifera*.—This is thicker, somewhat bitter. Roots of both are dug, washed, trimmed, assorted, cut into suitable lengths, dried, and marketed in bundles, bales, or bags; the former is usually *unpeeled*, the latter, consisting of roots and root-branches, is mostly *peeled*. It not only grows wild and under cultivation in

FIG. 198.

*Glycyrrhiza glabra.*

Russia, but also in Turkey and Hungary, being imported via Hamburg. The English root is met with sometimes both dried and fresh, mostly in pieces several feet long.

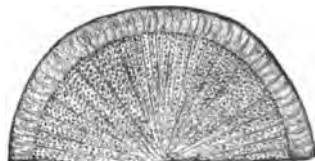
**ADULTERATIONS.**—The one variety of the root with the other, as they often are collected together; also the underground stem, which resembles the root, but has a thin central pith.

**CONSTITUENTS.**—Glycyrrhizin,  $C_{42}H_{62}NO_{16}$ , 6 p. c., Glycyramarin,  $C_{34}H_{52}NO_{13}$  (bitter principle, mostly in the bark), sugar, asparagin 2–4 p. c., fat 0.8 p. c., volatile oil 0.03 p. c., gum, tannin, starch, resin, yellow coloring matter.

**Glycyrrhizin.**—This is combined with ammonia, being called glycyrrhizate of ammonium or glycyrrhizic acid. It is a tribasic acid (glucoside) obtained from cold infusion by coagulating albumin with heat,

FIG. 200.

FIG. 199.

*Glycyrrhiza glabra* (rhizome), natural size.*Glycyrrhiza glandulifera* (root).

filtering, precipitating with sulphuric acid, washing precipitate with water, dissolving same in alcohol to which a little ether has been added (or in very weak ammonia water, 1 to 10), filtering, evaporating. It is very soluble in water, sparingly in alcohol, ether; when boiled with diluted sulphuric acid (by hydrolysis) splits into parasccharic acid (glucose),  $C_6H_{10}O_8$ , and bitter resinous glycyrrhetin,  $C_{32}H_{47}NO_4$ .

**PREPARATIONS.**—1. *Extractum Glycyrrhizæ*. Extract of Glycyrrhiza. (Syn., Extract of Licorice, Extractum Liquiritiæ, Licorice; Fr. Suc (jus) de Réglisse, Sucre noir; Ger. Succus Liquiritiæ, Süssholzsafft, Lakritz, Lakritzensafft.)

**Manufacture:** Evaporate decoction to proper consistency, powder or mould into flattened cylindrical rolls, 15–18 Cm. (6–7') long, 15–30 Mm. ( $\frac{3}{8}$ – $1\frac{1}{8}$ ') thick; this is the commercial extract, and has a glossy black color, sharp conchoidal shining fracture, very sweet peculiar taste. At least 60 p. c. should be soluble in cold water. Dose, *ad libitum*.

**Preps.:** 1. *Trochisci Glycyrrhizæ et Opii*. Troches of Glycyrrhiza and Opium. (Syn., Br. Trochisci Opii, Opium Lozenges; Fr. Pastilles de Réglisse opiacées; Ger. Opiumpastillen.)

**Manufacture:** Extract of glycyrrhiza 15 Gm., powdered opium .5, acacia 12, sugar 20, oil of anise .2 Cc., water q. s. 100 troches. Dose, 1 troche occasionally.

2. *Trochisci Ammonii Chloridi*, 3 gr. (.2 Gm.). 3. *Trochisci Cubeæ*,  $3\frac{3}{4}$  gr. (.2 Gm.). 4. *Pilulæ Ferri Iodidi*,  $\frac{1}{8}$  gr. (.01 Gm.).

2. *Extractum Glycyrrhizæ Purum*. Pure Extract of Glycyrrhiza. (Syn., Br. Extractum Glycyrrhizæ. Extractum Glycyrrhizæ Depuratum; Fr. Extrait de Réglisse (pur); Ger. Succus Liquiritiæ depuratus, Gereinigter Süssholzsafft, Süssholzextrakt.)

**Manufacture:** Macerate, percolate glycyrrhiza 100 Gm. with ammonia water 15 Cc. + water 300, finishing with latter alone q. s. to exhaust, evaporate to pilular consistency, while warm incorporate 5 p. c. by weight of glycerin; yield 16–25 p. c. Dose, *ad libitum*.

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Prep.: 1. *Mistura Glycyrrhizæ Composita*. Compound Mixture of Glycyrrhiza. (Syn., Brown Mixture; Fr. Mixture de Réglisse; Ger. Lakritzenmixture.)

*Manufacture*: Rub pure extract of glycyrrhiza 3 Gm., acacia 3, with water 50 Cc., when dissolved add syrup 5, camphorated tincture of opium 12, wine of antimony 6, spirit of nitrous ether 3, water q. s. 100 Cc. Dose, ʒj–4 (4–15 Cc.).

3. *Fluidextractum Glycyrrhizæ*. Fluidextract of Glycyrrhiza. (Syn., Extractum Glycyrrhizæ Fluidum, U. S. P. 1890; Br. Extractum Glycyrrhizæ Liquidum; Fr. Extrait liquide de Réglisse; Ger. Flüssiges Süßholzextrakt.)

*Manufacture*: Macerate, percolate with boiling water q. s., evaporate to 45 Cc., when cool add alcohol 45 Cc., let stand 3 days, filter, distil until 50 Cc. obtained, add to liquid in the still glycerin 25 Cc., ammonia water 5, alcohol 20, water q. s. 100 Cc. Dose, ʒss–1 (2–4 Cc.).

Preps.: 1. *Elixir Adjuvans*. Adjuvant Elixir. (Syn., Elixir Adjuvant, Flavoring Elixir; Ger. Gewürzhaftes Lakritzenelixir.)

*Manufacture*: Mix fluidextract of glycyrrhiza 12 Cc. with aromatic elixir 88 Cc., filter. Dose, *ad libitum*; as a flavoring vehicle.

2. *Syrupus Sarsaparillæ Compositus*, 1.5 p. c.

4. *Glycyrrhizinum Ammoniatum*. Ammoniated Glycyrrhizin. (Syn., Fr. Glycyrrhizine Ammoniacale; Ger. Ammoniak Glycyrrhizin.)

*Manufacture*: Macerate, percolate glycyrrhiza 100 Gm. with ammonia water 5 Cc. + water 95, then with water alone q. s. 100 Cc., precipitate with q. s. sulphuric acid, wash, redissolve in water + little ammonia water, again filter and precipitate with q. s. sulphuric acid, wash, dissolve in diluted ammonia water and spread on glass to dry. It is in brownish-red scales, odorless, very sweet, readily soluble in water and alcohol; adding an acid to aqueous solution precipitates glycyrrhizin, which dissolved in hot water forms a jelly on cooling, and this washed with diluted alcohol and dried, appears as an amorphous, yellow powder, with strong bitter-sweet taste, acid reaction. Dose, gr. 5–15 (.3–1 Gm.).

5. *Pulvis Glycyrrhizæ Compositus*. Compound Powder of Glycyrrhiza. (Syn., Fr. Poudre pectorale de Réglisse composée; Ger. Pulvis Liquiritiæ Compositus (Pectoralis Kurellæ), Brustpulver.)

*Manufacture*: Glycyrrhiza 23.6 Gm., senna 18, washed sulphur 8, oil of fennel .4, sugar 50. Dose, ʒss–2 (2–8 Gm.).

6. *Extractum Euonymi*, q. s. 7. *Extractum Leptandræ*, q. s. 8. *Extractum Physostigmatis*, q. s. 9. *Extractum Rhamni Purshianæ*, q. s. 10. *Fluidextractum Rhamni Purshianæ Aromaticum*, 10 p. c. 11. *Massa Hydrargyri*, 10 p. c. 12. *Pilulæ Ferri Iodidi*,  $\frac{3}{4}$  gr. (.04 Gm.). 13. *Pilulæ Laxativæ Compositæ*,  $\frac{3}{4}$  gr. (.05 Gm.). 14. *Pulvis Morphine Compositus*, 33 p. c. 15. *Tinctura Aloes*, 20 p. c. 16. *Tinctura Aloes et Myrrhæ*, 10 p. c.

Unoff. Preps.: *Syrup*.—Macerate root 20 parts in water 100 + am-

monia water 10, for 12 hours, boil, filter, evaporate to 10, add alcohol 10, let stand 12 hours, filter, add syrup q. s. 100 parts. Or may make from fluidextract 2 + syrup 8 parts. Dose, *ad libitum*, mostly for flavoring.

**PROPERTIES.**—Demulcent, expectorant, laxative; locally—slight stimulant. Increases, when chewed, the flow of saliva and mucus, which secretions are emollient to the throat.

**USES.**—Febrile catarrhal conditions, bronchitis, bowel and urinary affections; here should be prepared with flaxseed, rice, barley, or gum water. In pharmacy used to mask taste of aloes, ammonium chloride, bitter sulphates, colocynth, guaiacum, hyoscyamus, mezereum, senega, senna, quinine, turpentine, etc. Mechanically as an excipient and dryer in pills, troches, etc.

*Allied Plants:*

1. *Glycyrrhiza echina'ta*.—Europe, Hungary, S. Russia; flowers in globular heads, pod ovoid with long spines. *G. lepidota*. United States (Mo., Minn.).

2. *A'brus precato'rius*, *Indian* or *Wild Licorice*, *Jequirity*.—India, Brazil. Seeds used as standard weight, and for criminal poisoning, although inert when taken whole; contain *abrin*, having the action of snake-venom, being cardiac depressant; root contains glycyrrhizin, and becomes a poor substitute for licorice.

3. *Ono'nis spino'sa*, *Rest-harrow*.—Europe. Root .6 M. ( $2^{\circ}$ ) long, 12 Mm. ( $\frac{1}{2}'$ ) thick; odor and taste similar to official licorice.

4. *Glyc'ine (So'ja) his'pida*, *Soja Bean*. Japan; cultivated S. Asia; contains casein 40 p. c., fat 18, dextrin 10, starch 5, cellulose 5, water 10, amylolytic ferment. Owing to the beans containing so little starch they are ground into flour, and this made into bread for diabetic patients, in order to decrease sugar in the urine.

## SCOPARIUS. SCOPARIUS.

### Cytisus

**Scoparius**, (Linné) Link. } The dried tops.

**Habitat.** W. Asia, S. and W. Europe (W. Siberia, Great Britain)—sandy soil; naturalized in middle and southern United States; cultivated in gardens.

**Syn.** Broom, Green, Scotch, Common or Irish Broom, Hogweed, Bannal; Br. Scoparii Cacumina, Broom Tops; Fr. Genêt à balais; Ger. Besenginster, Pfriemenkraut.

**Cyt'isus.** L. fr. G. κύθισος, classic name, after island of Cythrus, one of the Cyclades—i. e., where first found growing.

**Sco-pa'ri-us.** L. fr. scopæ, twigs, shoots, a broom—i. e., made of twigs, twiggy.

**PLANT.**—Shrub 1.2–2.4 M. ( $4-8^{\circ}$ ) high; stem 2.5–5 Cm. ( $1-2'$ ) thick, with many pentangular, green, flexible, wand-like branches; leaves alternate, small, oblong, downy, trifoliate; leaflets sessile, 6–12 Mm. ( $\frac{1}{4}-\frac{1}{2}'$ ) long, lanceolate; flowers May–June, many, large, racemes, brilliant yellow, papilionaceous; fruit pod, 4 Cm. ( $1\frac{3}{4}'$ ) long, 6 Mm. ( $\frac{1}{4}'$ ) wide, compressed 12–18-seeded, entire plant with nauseous taste; peculiar odor. Tors, in thin flexible branched twigs, 2–3 Mm. ( $\frac{1}{2}-\frac{3}{4}'$ ) thick, dark green, with 5 wings and numerous reddish-brown cork

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patches, internally yellowish, younger branches somewhat pubescent, fracture short fibrous, that of thick pieces tough and splintery, usually free from the simple, obovate leaves; odor peculiar when bruised; taste disagreeably bitter. *Solvents*: water; alcohol. Dose, gr. 15–30 (1–2 Gm.).

**CONSTITUENTS.**—Sparteine 0.03 p. c., Scoparin, Volatile oil, tannin, fat, wax, sugar, ash 5–6 p. c.

**Sparteine**,  $C_{15}H_{26}N_2$ .—This alkaloid is a cardiac stimulant, narcotic, and is obtained by distilling mother-waters of scoparin, or by exhausting plant with acidulated ( $H_2SO_4$ ) water, distilling concentrated liquid with sodium hydroxide. It is a colorless, oily liquid, brown upon exposure, aniline odor, bitter, soluble in alcohol, ether, chloroform; yield 3j (4 Cc.) from 25 pounds (11 Kg.) of plant; forms salts (hydrochloride, hydriodide, sulphate, etc., all in crystalline form).

**Sparteinae Sulphas, Sparteine Sulphate**,  $C_{15}H_{26}N_2H_2SO_4 + 4H_2O$ , *official*.—(Syn., Fr. Sulfate de Sparteine; Ger. Sparteinsulfat.) Obtained by neutralizing the alkaloid sparteine with sulphuric acid and crystallizing.

It is a neutral sulphate, in white prismatic crystals or powder, odorless; saline, bitter taste; absorbs moisture; no residue, soluble in water, alcohol. *Test*: 1. Shake 0.05 Gm. + 5 Cc. potassium hydroxide or sodium T. S. in a test-tube; liquid becomes turbid, and small drops of sparteine gradually collect on the surface; now place a strip of moistened red litmus paper at the mouth, heat gently; paper turns blue, but no ammoniacal odor (abs. of ammonium salts). Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.01–.03 Gm.).

**Scoparin**,  $C_{21}H_{22}O_{10}$ .—This glucoside is diuretic, and is prepared from the concentrated decoction, which gelatinizes on standing; this jelly is expressed, purified by repeated solution in hot water and finally in hot alcohol. It is in pale yellow crystals, or amorphous powder, odorless, tasteless, soluble in alcohol, hot water, alkalies. Dose, gr. 1–10 (.06–.6 Gm.).

**PREPARATIONS.**—(Unoff.) *Fluidextract* (diluted alcohol), dose, 3ss–1 (2–4 Cc.). *Decoction*, 5 p. c., dose, 5j–2 (30–60 Cc.). *Infusum Scoparii* (Br.), 10 p. c., dose, 5j–2 (30–60 Cc.). *Succus Scoparii* (Br.), 10 p. c. + alcohol 90, dose, 3j–2 (4–8 Cc.).

**PROPERTIES.**—Cardiac stimulant, diuretic, narcotic; large doses emetic, cathartic, paralyzing respiratory and motor centres; causes tonic

FIG. 201.

*Cytisus Scoparius*: flowering branch.

convulsions, death by asphyxia; normal doses strengthen heart-beats, slow the rate (acting directly on the cardiac muscle and the inhibitory apparatus), increase cutaneous and renal circulation (flow of urine and excretion of urea); may quicken pulse when abnormally slow, acting as a regulator.

**USES.**—Cardiac affections, palpitation, asthma, dropsies, chronic Bright's disease (nephritis); inferior to digitalis, although having the advantage of quicker action (within 20 minutes), and no cumulative effect; should not be given in acute kidney affections. Dropsical sheep are benefited by it, and sometimes it is substituted for hops.

**Poisoning:** Similar to digitalis. Give strychnine, atropine, electricity (respiration), tannin, potassium iodide, diuretics, diluents.

**Incompatibles:** Tannic acid, potassium iodide.

**Synergists:** Digitalis, strophanthus, etc.

**Allied Plants:**

1. *Spar'tium jun'ceum*, *Spanish Broom*.—Leaves soft, hairy; seeds reniform, properties like official; fibres used for cordage, coarse cloth, etc.

2. *Baptis'ia tincto'ria*, *Wild or False Indigo*.—The whole plant, official 1830–1840; root now used. N. America. Plant .6–1 M. (2–3°) high, smooth, succulent, glaucous; flowers yellow, root most active; has head with knotty branches; plant has disagreeable odor when bruised; taste bitter, acrid, nauseous; contains cytisine (baptitoxine—acrid, poisonous), baptisin (non-active bitter glucoside), baptin (purgative glucoside); used as a stimulant for scarlatina, typhus, dysentery; locally—aphthæ, ulcers, etc.; in decoction, infusion. Dose, gr. 5–15 (.3–1 Gm.); baptisin gr. 2–6 (.13–.4 Gm.); large doses emetic, cathartic—death by respiratory paralysis.

## ARAROA. GOA POWDER.

**Chrysarobinum.** *Chrysarobin*,  $C_{30}H_{26}O_7$ , *official*.

**Vouacapoua** { A neutral principle extracted from Goa  
**Araroba**, (*Aguar*) *Druce*. { Powder, a substance found deposited in  
the wood of this plant.

**Habitat.** Brazil, Bahia; in damp forests.

**Syn.** Araroba or Arariba Tree, Po(h)de Bahia, Crude Chrysarobin; Fr. Poudre de Goa, Chrysarobine; Ger. Goa Pulvre, Chrysarobin.

**Vou-a-ca-pou'a.** L. fr. native C. American name (nomen caribæum), *voicapou*.

**Ar-a-ro'ba.** L. fr. E. India name, *ar(ar)oba*, as applied to the bark.

**Chrys-ar-o-bi'num.** L. for *Chry-sar'o-bin*, fr. Gr. χρυσός, gold, + *ar(ar)oba*.

**Go'a.** After Portuguese colony of Goa, on the Malabar coast of India, to which it was imported from Bahia, in Brazil, 1852.

**PLANT.**—The *Vouacapoua Araroba* or Po' de Bahia is a large tree 24–30 M. (80–100°) high, closely allied to the W. Indies “Cabbage Tree”; trunk smooth, spheroidal, head not very bushy; leaves paripinnate, with long petioles; flowers purple, paniculate racemes; wood yellow, with numerous longitudinal canals and many irregular transverse interspaces or lacunæ, in which the Goa Powder is found—a

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result of decay or chemical changes in the cell-walls of the trunk-wood (medullary rays), being possibly an antiseptic preservative of the plant; yields much chrysophanic acid by oxidation.

*Commercial.*—Tree resembles the copaiba, and is called natively *Angelin Amargosa*; the oldest yield most powder, which is obtained by felling, splitting the tree, and then scraping the powder from the clefts, those doing this often suffering with irritated eyes and face; occurs as a light yellow powder when fresh, but brownish on exposure, slightly crystalline, rough, mixed with wood fibres, inodorous, bitter; 7 p. c. soluble in water, 80 p. c. in benzene, 50 p. c. in hot chloroform.

*CONSTITUENTS.*—GOA POWDER: Chrysarobin 65–85 p. c., gum 7 p. c., resin 2 p. c., bitter extractive 7 p. c., woody fibre 5 p. c., ash 0.3–3 p. c.

*Chrysarobinum. Chrysarobin.*—This is obtained by hot benzene; it is a pale orange-yellow, micro-crystalline powder, odorless, tasteless, irritating to mucous membrane, sp. gr. 0.922, soluble in 25 parts benzene, 18 chloroform, 114 ether, 308 alcohol, 30 amyl alcohol, 4,812 water, 230 carbon disulphide, no residue. *Tests:* 1. Dissolves in sulphuric acid forming deep red solution, which poured into water deposits chrysarobin unchanged. 2. Shaken with lime water gives violet-colored liquid (dis. from chrysophanic acid, which yields yellow liquid). 3. Shake 1 Gm. + 10 Cc. potassium hydroxide T. S. get yellow, yellowish-red, deep red, due to absorbing oxygen from the air, thus producing chrysophanic acid:  $C_{30}H_{26}O_7 + O_4 = 2C_{15}H_{10}O_4 + 3H_2O$ , or inversely:  $2C_{15}H_{10}O_4 + H_8 = C_{30}H_{26}O_7 + H_2O$ . Chrysarobin gives brown mass with melted potassium hydroxide, and is nearly insoluble in diluted potassium hydroxide solution, while chrysophanic acid gives blue mass, and is soluble in latter solution with red color. Dose, gr.  $\frac{1}{8}$  (.008 Gm.).

*PREPARATION.*—1. *Unguentum Chrysarobini.* Chrysarobin Ointment. (Syn., Fr. Pommade de Chrysarobine; Ger. Chrysarobinsalbe.)

*Manufacture:* 6 p. c. Triturate 6 Gm. with benzoated lard 95, previously melted, heat on a water-bath 20 minutes, occasionally stirring, strain (thereby removing about 1 p. c.), stir until it congeals.

*PROPERTIES.*—Irritant, in doses of gr. 20 (1.3 Gm.) gastro-intestinal irritant, causing large watery, bilious stools, vomiting, nausea. Externally—produces diffuse dermatitis, followed by follicular and furuncular inflammation; stains skin dark brown, removed by chlorinated lime.

*USES.*—Parasitic skin diseases of vegetable origin, ringworm, acne, favus, psoriasis, chronic eczema, hemorrhoids.

*Allied Compounds:*

1. *Anthrarobin (Desoxyalizarin)*,  $C_{14}H_{10}O_{13}$ .—Obtained from the coal-tar product alizarin by action of nascent hydrogen; it is a strong deoxidizing agent, miscible with fats, weaker, less irritating and toxic than chrysarobin, soluble in alcohol, glycerin.

2. *Hydroxylamine Hydrochloride*,  $NH_2OHHCl$ .—This does not stain the skin, hence often is preferred to the other reducing agents



(chrysarobin, pyrogallol, anthrarobin, etc.) in skin diseases, but being a poison care should be exercised not to allow too much to be absorbed by the system.

### PHYSOSTIGMA. PHYSOSTIGMA.

**Physostigma venenosum**, Balfour. } The ripe seed, containing 0.15 p. c. of ether-soluble alkaloids.

*Habitat.* W. Africa (near mouths of Niger and Old Calabar Rivers, in the Gulf of Guinea); introduced into India and Brazil.

*Syn.* Calabar Bean, Ordeal Bean, Chop Nut, Split Nut; Br. *Physostigmatis Semina*; Fr. Fève de Calabar; Ger. Faba Calabarica, Kalabarbohne.

**Phy-so-stig'ma.** L. fr. Gr. *phōsa*, a bladder, + *stigma*, stigma—i. e., stigmatic appendage is hollow and inflated.

**Ven-e-no'sum.** L. *venenosus*, full of poison, poisonous—i. e., plant's property. Cal'a-bar Bean—i. e., bean from the Calabar district on W. African coast.

FIG. 202.



*Physostigma venenosum.*

**PLANT.**—Woody, perennial climber; stem 12–15 M. (40–50°) long, 5 Cm. (2') thick, smooth, resembles our scarlet runner and Spanish bean (genus *Phase'olus*); root spreading, fibrils many, having at-

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tached small succulent tubers; leaves large, pinnately trifoliate; leaflets 7.5–15 Cm. (3–6') long, stipulate, ovate pointed; flowers purplish, racemes; fruit June–Sept., pod 10–17.5 Cm. (4–7') long, compressed, pointed, pale brown, 2-valved, reticulately veined, dehiscent, inside woolly, 2–3-seeded. SEED, 25 Mm. (1') long, 15 Mm. ( $\frac{3}{8}$ ') broad, 12 Mm. ( $\frac{1}{2}$ ') thick, oblong, reniform, testa reddish- or chocolate-brown, smooth, somewhat roughened near brownish-black groove which extends almost the entire length of convex edge, its reddish, rounded margins elevated, somewhat thickened; embryo whitish, with short, curved hypocotyl and 2 large, concavo-convex cotyledons; when crushed odor heavy, bean-like; taste starchy, acid. Embryo 72 p. c., integuments 28 p. c., the former on moistening with potassium hydroxide T. S. becomes pale yellow. Solvent: alcohol. Dose, gr. 1–4 (.06–.26 Gm.).

ADULTERATIONS.—1. *P. cylindrosperma*, seeds 4 Cm. ( $1\frac{3}{4}$ ') long, nearly cylindrical, groove and hilum shorter, not extending quite to the end. 2. *En'tada scan'dens*, seed, round, flat, 5 Cm. (2') broad, also Oil Palm Seeds and seeds of *Mucuna* species. None of these resembles to any extent the official.

CONSTITUENTS.—Physostigmine (eserine) 0.1 p. c., Eseridine, eseramine,  $C_{16}H_{25}N_3O_3$  (crystalline physiologically inactive), calabarine (liquid, not yet obtained pure, antagonistic to physostigmine, tetanic, may cause diarrhœa, soluble in alcohol, water, insoluble in ether), phytosterin (neutral principle resembling cholesterolin, crystallizes from ether, chloroform, petroleum benzin in silky needles, from alcohol in scales, inactive), starch 48 p. c., proteids (albumin) 23 p. c.; gum, fat, ash 3–4 p. c.

FIG. 203.



Physostigma: view from the side and edge, showing length of hilum.

FIG. 204.



Physostigma split, showing cotyledons.

FIG. 205.



*Physostigma cylindrosperma*.

**Physostigmine**,  $C_{15}H_{21}N_3O_2$ .—Chiefly in embryo; obtained by mixing powdered bean with 1 p. c. tartaric acid, exhausting with alcohol, evaporating; treat residue with water, agitate filtrate with ether to remove color, add sodium bicarbonate, shake with ether, evaporate, getting colorless, amorphous physostigmine; hygroscopic, liquefies at 45° C. (113° F.), tasteless, soluble in alcohol, ether, chloroform, benzene, carbon disulphide, slightly in water; forms salts (benzoate, citrate, hydrobromide, hydrochloride, nitrate, etc.). With alkalis or chlorin-

ated lime yields red *rubreserine*; with sulphuric acid gives yellow, then olive-green. Dose, gr.  $\frac{1}{120}$ — $\frac{1}{60}$  (.0005—.001 Gm.).

**Physostigminæ Salicylas, Physostigmine Salicylate**,  $C_{15}H_{21}N_3O_5$ ,  $C_7H_5O_3$ , *official*.—(Syn., Eserine Salicylate; Fr. Salicylate d'Éserine; Ger. Physostigminsalicylat.) Obtained by neutralizing alcoholic or ethereal solution of the alkaloid with salicylic acid, allowing to crystallize; occurs in faintly yellowish crystals, odorless, bitter, reddish upon exposure, soluble in 72.5 parts water, 12.7 alcohol, 175 ether, 8.6 chloroform, no residue. *Tests*: 1. Aqueous solution evaporated to dryness, + few drops ammonia water gives blue residue, soluble in alcohol, becoming red fluorescent with excess acetic acid. 2. Platinic chloride T. S. does not precipitate solutions (dis. from physostigmine sulphate). 3. Ferric chloride T. S. gives deep violet; potassium hydroxide T. S. cherry-red. Should be kept in small, well-stoppered, dark amber-colored vials. Dose, gr.  $\frac{1}{120}$ — $\frac{1}{60}$  (.0005—.001 Gm.).

**Physostigminæ Sulphas, Physostigmine Sulphate**,  $(C_{15}H_{21}N_3O_5)_2 \cdot H_2SO_4$ , *official*.—(Syn., Eserine Sulphate; Fr. Sulfate d'Éserine; Ger. Physostigminsulfat.) Obtained by neutralizing alcoholic or ethereal solution of the alkaloid with sulphuric acid, allowing to crystallize; occurs in yellowish-white micro-crystalline powder, odorless, bitter, very deliquescent, reddish upon exposure, soluble in water, alcohol, chloroform, 12 parts ether, no residue. *Tests*: 1. Alkalies yield white precipitate, quickly turning pink, soluble in excess with pink or red solution, soon fading to yellowish-green. 2. Platinic chloride T. S. gives yellowish-white precipitate (dis. from physostigmine salicylate). 3. Barium chloride T. S. gives white precipitate, insoluble in hydrochloric acid; sulphuric acid yields faint yellow color. Should be kept in small, well-stoppered, dark amber-colored vials. Dose, gr.  $\frac{1}{120}$ — $\frac{1}{60}$  (.0005—.001 Gm.).

**Eseridine**,  $C_{15}H_{23}N_3O_3$ .—Derivative of physostigmine, from which it differs by containing  $H_2O$ , and into which it can be converted by dilute acids; obtained from its mother-liquor by precipitating with lead subacetate and ammonia, evaporating filtrate, treating residue with alcohol, precipitating with phosphotungstic acid, decomposing with baryta; occurs in 4-sided crystals, soluble in alcohol, chloroform, ether, acts similar to physostigmine. Dose, gr.  $\frac{1}{20}$ — $\frac{1}{10}$  (.003—.006 Gm.).

**Assay**: Exhaust the drug (20 Gm.) with alkaline solution (sodium bicarbonate) of ether (200 Cc.), shake out tincture (100) with normal sulphuric acid V. S.; transfer latter solution to a second separator, make alkaline with sodium bicarbonate solution, shake out with ether 25, 20, 15; evaporate ether solutions to dryness, dissolve in  $\frac{N}{10}$  sulphuric acid V. S. (5) and ether (20), titrate excess of acid with  $\frac{N}{50}$  potassium hydroxide V. S., using iodeosin T. S. indicator. Divide number Cc. of  $\frac{N}{50}$  potassium hydroxide V. S. by 5, subtract quotient from 5, multiply remainder by 0.0273, and this product by 10 = p. c.; or from amount of  $\frac{N}{10}$  sulphuric acid V. S. found to have been neutralized by the alkaloidal principles the p. c. present is calculated—each Cc.  $\frac{N}{10}$  sulphuric acid V. S. corresponds to 0.0273 Gm. of alkaloids.

PAPILIONACEÆ.

PREPARATIONS.—1. *Extractum Physostigmatis*. Extract of Physostigma. (Syn., Fr. Extrait de Fève de Calabar; Ger. Extractum Fabæ Calabaricæ, Kalabarbohnextrakt.)

*Manufacture*: Contains 2 p. c. ether-soluble alkaloids; macerate, percolate 100 Gm. with alcohol, evaporate to dryness; assay 1 Gm. and calculate therefrom amount of ether-soluble alkaloids in the remainder, add powdered glycyrrhiza (peeled Russian) sufficient to make quantity of the alkaloids in finished powdered extract 2 p. c.; reduce to powder, mix thoroughly. *Assay*: Digest 1 Gm. in 5 Cc. diluted alcohol, add fine quartz sand 5 Gm., evaporate with trituration to dryness, add ether 100 Cc., shake, add 10 Cc. aqueous solution of sodium bicarbonate (1 in 20), shake, decant into separator 50 Cc. ether solution, shake out with normal sulphuric acid V. S. and proceed approximately as in assay of physostigma. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{10}$ — $\frac{1}{2}$  (.006–.03 Gm.).

2. *Tinctura Physostigmatis*. Tincture of Physostigma. (Syn., Fr. Teinture de Fève de Calabar; Ger. Kalabarbohrentinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with alcohol q. s. 100 Cc.; when assayed each 100 Cc. should contain 0.014 Gm. of ether-soluble alkaloids. *Assay*: Evaporate 100 Cc. to dryness, and proceed approximately as in assay of the extract, except multiply the product by 2 instead of 200. Dose, Mv–20 (.3–1.3 Cc.).

*Unoff. Prep.*: *Lamellæ Physostigminæ* (Br.)  $\frac{1}{1000}$  gr. (.00006 Gm.).

PROPERTIES.—Sedative, myotic, motor depressant, paralyzant, emetic, purgative, diaphoretic, sialagogue, poisonous. Stimulates salivary, gastric, and intestinal secretions, peristalsis, acting directly upon the unstriated muscle-fibres, quickens breathing, then retards it, heart becomes slow and irregular, but more powerful, finally feeble and ceasing altogether, depresses, ultimately paralyzes spinal cord reflex, and motor centres.

USES.—Tetanus, chorea, epilepsy, progressive paralysis, tonic convulsions, gastralgia, strychnine and atropine poisoning, constipation (combined with belladonna and nux vomica). Externally—in neuralgia, muscular rheumatism, malignant tumors. Physostigmine ( $\frac{1}{2}$  p. c. in water, few drops into eye) for breaking up ocular adhesions (iris, cornea, lens), lessen intraocular tension, iritis, corneal ulcers, prolapsed iris, paralysis of the iris accommodation following diphtheria, glaucoma. In Africa as *ordeal bean* of Calabar for punishing criminals and for witchcraft, the accused having to eat them until they vomit or die: if former, innocent; latter, guilty. A paste of 20 seeds will kill.

*Poisoning*: Have nausea, giddiness, indistinct vision, diminished heart action, muscular tremors and weakness, then complete relaxation, retarded respiration, motor paralysis, sphincters contract, cold extremities, skin covered with cholera-like sweat. Conscious until death, which is caused by carbon dioxide narcosis, and paralysis of muscles of respiration. Evacuate stomach (emetics, pump); give atropine hypodermically, gr.  $\frac{1}{80}$  (.002 Gm.); tannin, hydrated chloral (spine),

strychnine, diffusible stimulants, coffee, ammonia, digitalis, alcohol, artificial heat and respiration, electricity. Empty bladder often (catheter), as the drug is eliminated by kidneys (bile and saliva), and urine becomes poisonous.

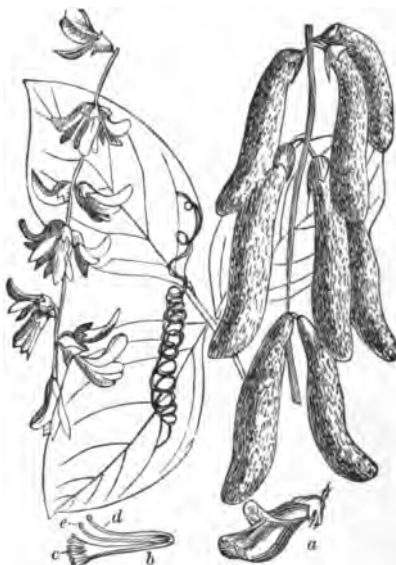
*Incompatibles*: Vegetable astringents, tannin, caustic alkalies, atropine, hydrated chloral, motor and tetanizing excitants.

*Synergists*: Motor depressants, conium, gelsemium, amyl nitrite, etc.

*Allied Plant*:

1. *Mucu'na pruriens*, *Cowhage*, *Cowitch*.—Hairs of the pods, official 1820–1880. E. and W. Indies. Climbing plant, flowers resemble those of the pea, purple; leaflets hairy; pods coriaceous, shape of italic letter *f*, 10 Cm. (4') long, covered with brown hairs, 2.5 Mm. ( $\frac{1}{10}$ ') long, stiff, filled with brown granular matter, readily penetrating the skin, causing violent itching. Detached from pods (which then are eaten as also when green in India) by dipping into honey, scraping into paste; contains resin, tannin. Used as anthelmintic for round worms; irritant in

FIG. 206.



*Mucuna pruriens*: a, flower; b, stamen system; c, anthers; d, filament; e, anther.

paralysis. Action on worms thought to be mechanical. Dose, gr. 1–3 (.06–.2 Gm.), followed by calomel, jalap; ointment also used.

#### 40. GERANIACEÆ. Cranesbill or Geranium Family.

Je-ra-ni-a'se-e. L. *Gerani-um* + aceæ, fem. pl. of *geraniaceus*, fr. Gr. γέρανος, a crane—i. e., called cranesbill from resemblance of the long beak of seed capsule. Herbs or shrubs with stipules and swollen joints. Distinguished from Rutaceæ by leaves non-glandular, non-

**GERANIACEÆ.**

punctate; axis of lobed fruit persistent; carpels distinct, indehiscent; flowers often showy and irregular; sepals 5; petals 5; stamens 10; ovary lobes as many as sepals with common style, superior; fruit capsular, seed exalbuminous; universal; astringent, aromatic, resinous, perfumery.

Genus: 1. *Geranium*.

**GERANIUM. GERANIUM.**

*Geranium*  
*maculatum*, Linné. } The dried rhizome.

*Habitat.* N. America (Canada, United States); rich woods, thickets.

*Syn.* Cranesbill, Alum, American Kino or Astringent Root, American Tormentilla, Crowfoot, Stork's-bill, Spotted or Wild Geranium—Crane's-bill—Dovefoot; Fr. Racine de Bec-de-Grue tacheté, Racine de Pied-de-Corneille; Ger. Fleckstorchschnabelwurzel.

*Ge-ra-ni-um.* L. see etymology, page 336, of Geraniaceæ.

*Mac-u-la'tum.* L. *maculatus*, *macula*, spotted, spot—i. e., leaves acquire white spots by age.

**PLANT.**—Perennial herb; stem green, erect, hairy, .3–.6 M. (1–2°) high; leaves palmately 5–7-lobed, each lobe incised at extremity, wedge-shape, hairy, pale green with paler spots; flowers April–June, large, 2.5–4 Cm. (1–1½') wide, purplish, umbels; petals 5, entire, bearded, on claw 12 Mm. (½') long; fruit long-beaked, with 5 1-seeded carpels. **RHIZOME**, of horizontal growth, cylindraceous, somewhat flattened, 2.5–10 Cm.

(1–4') long, 3–15 Mm. (⅛–⅜') thick, sharply tuberculated, longitudinally wrinkled, dark brown, fracture short, light reddish-brown or purplish, bark thin, few short, broad yellowish wood-wedges scattered near dark cambium, central pith large; odor slight; taste strongly astringent. Should be collected just before flowering, or in early autumn, washed and dried.

Was very popular with North American Indians, but now little used.

*Solvents:* alcohol; water. *Dose*, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—1. *Potentilla Tormentilla*. Europe, N. America, resembles our cinquefoil. 2. *Polygonum Bistorta*. United States. 3. *Sanguinaria canadensis*. N. America. 4. *Roots* of all allied species.

**CONSTITUENTS.**—Tannin 10–28 p. c., Gallic acid, resin, red coloring-matter—geranium-red formed from the tannin (starch, pectin, sugar).

**Tannin.**—Present in largest amount in April, sweetest in October; it is analogous to gallo-tannic acid, yields blue-black with ferric salts and pyrogallol on heating; heated with hydrochloric acid yields glucose, gallic acid and geranium-red.

**Gallic Acid.**—None in the fresh plant, only slight amount in the dry rhizome.

The "Eclectic" resinoid extract, *geranin*, is made by precipitating the concentrated alcoholic tincture with water.

FIG. 207.



*Geranium maculatum*: rhizome and transverse section of rhizome and root, natural size.

PREPARATIONS.—1. *Fluidextractum Geranii*. Fluidextract of Geranium. (Syn., *Extractum Geranii Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Gêranium maculé*; Ger. *Flüssiges Fleckenstorchschnabelextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with glycerin 10 Cc., alcohol 60, water 30, finishing with alcohol 60 p. c., q. s., evaporate to 100 Cc. Dose, 3ss–1 (2–4 Cc.).

*Unoff. Preps.*: *Extract. Tincture. Decoction*, 5 p. c. This latter may be made with milk when preferred.

PROPERTIES.—Astringent, tonic (due to tannin); suited for infants and others having weak stomachs.

USES.—Similar to tannin; diarrhœa, chronic dysentery, cholera infantum, hemorrhages. Locally—gleet, leucorrhœa, aphthæ, relaxed vagina, throat, uvula, rectum, indolent ulcers.

*Allied Plants*:

1. *Geranium Robertia'num*.—Europe; popular astringent for hemorrhages, diuretic for gravel.

2. *Ero'dium (Geranium) moscha'tum, Stork's-bill*.—Diaphoretic.

3. *E. cicuta'rium, Heron's-bill*.—Diuretic, dropsy.

#### 41. LINACEÆ. Flax Family.

Li-na'se-e. L. *Lin-um* + *aceæ*, flax, fr. Celtic *llin*, a thread, whence Gr. *λίον*, L. *linum* (classic names), Eng. linen—*i. e.*, its fabric. Herbs. Distinguished by flowers being regular; stamens 5, monadelphous at base; sepals 5, imbricate, petals 5; ovary 2–5-celled, styles 2–5; fruit capsular, seeds 2 in each cell, albuminous, superior, universal; temperate climates; demulcent, purgative, stimulant, sedative, tonic; fibres, oil.

Genus: 1. *Linum*.

#### LINUM. LINSEED (FLAXSEED).

*Linum usitatissimum, Linné.* } The ripe seed.

*Habitat*. C. Asia, Egypt, S. Europe, cultivated in Russia, Egypt, India, United States, S. Europe, England, Holland; spontaneous in most temperate countries.

*Syn.* Flax, Lint-bells, Winter lien; Br. *Lini Semina*; Fr. *Semence (Graine) de Lin*; Ger. *Semen Lini, Leinsame, Flachssamen*.

*Li'num*. L. see etymology, above, of Linacæ.

*U-si-ta-tis-si-mum*. L. sup. adj. fr. *usitatus*, most useful, common, familiar.

*Flax'seed*. AS. *fleax, flechten*, to braid, plait, twist—*i. e.*, its fibres, + *seed*.

PLANT.—An annual; stem .6 M. (2°) high, stiff, erect, solitary, round, smooth, green; leaves small, lanceolate, acute, entire, sessile, pale green, 2–4 Cm. ( $\frac{1}{2}$ –1 $\frac{3}{4}$ ') long; flowers June–July; terminal, bluish; fruit August, globular capsule, size of pea, with persistent calyx at base, crowned with sharp spine, 10-seeded in distinct cells. SEED, 4–5 Mm. ( $\frac{1}{8}$ – $\frac{1}{6}$ ') long, ovate, oblong-lanceolate, flattened, obliquely pointed at one end, chestnut-brown, very smooth, glossy,

## LINACEÆ.

covered with transparent, mucilaginous outer wall which swells in water, embryo whitish or greenish, with 2 large plano-convex, oily cotyledons, embedded in a thin perisperm; odor slight; taste mucilaginous, oily. Ground linseed (Linseed Meal, Flaxseed Meal, *Linum Contusum* (Br.), *Lini Farina*, Crushed Linseed) should be recently prepared and free from unpleasant or rancid odor; it is a grayish-yellow powder containing brownish fragments, and when exhausted by carbon disulphide should yield not less than 30 p. c. fixed oil, all being saponifiable. *Test*: 1. Mix 0.1 Gm. with water 20 Cc., heat to boiling, cool, dilute with water 100 Cc., the addition of 0.5 Cc. iodine T. S. should not produce more than pale blue color (lim. of starch). *Solvent*: boiling water. Dose, ʒj-2 (4-8 Gm.).

FIG. 208.

*Linum usitatissimum.*

**ADULTERATIONS.**—**SEED**: Foreign seeds and earthy matter 1-25 p. c.—mustard, rape and other cruciferous seeds, sand, small stones; **POWDER**: Damaged flour, cornmeal, other starchy substances, recognized by microscope or iodine test; expressed cake and that to which mineral oil has been added.

**Commercial.**—The flax is of ancient origin, being prized for its fabric and medicinal properties; most of our seeds now come from Russia and Germany, but the United States furnishes considerable. When exposed to heat, light, damp atmosphere, or otherwise carelessly preserved, especially the ground, it is subject to insect attack, and should not be used after 1 year old.

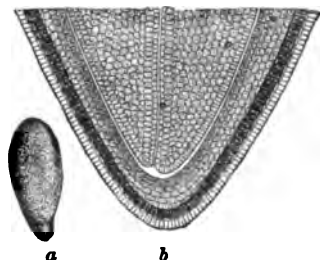
**CONSTITUENTS.**—Fixed oil 35-40 p. c. (in nucleus), Mucilage,  $C_{12}H_{20}O_{10}$ , 15 p. c. (in epithelium), proteids 25 p. c., amygdalin, (resin, wax, sugar, no starch (except in young seed), ash 5 p. c. = phosphates, sulphates, chlorides of potassium, calcium, and magnesium).

**Oleum Lini.** Linseed Oil, *official*.—(Syn., Oil of Flaxseed; Fr.



Huile de Lin ; Ger. Leinöl, Leinsamenöl.) A fixed oil expressed from linseed without heat. Usually, however, the seeds are dried with heat, then crushed and pressed; yield by cold process 16–20 p. c., by heat 25–28 p. c. It is a yellowish, oily, limpid liquid, peculiar odor, bland taste; by exposure thickens, darkens, acquiring a strong odor and taste; sp. gr. 0.930; congeals at  $-20^{\circ}$  C. ( $-4^{\circ}$  F.); soluble in ether, chloroform, oil of turpentine, 10 parts alcohol. Consists of liquid glycerides of oleic acid,  $C_{18}H_{34}O_2$ , 85–90 p. c., mixture of palmitin, myristin and stearin 10–15 p. c., linoleic acid,  $C_{18}H_{32}O_2$ , linolenic acid,  $C_{18}H_{30}O_2$ , isolinoleic acid,  $C_{18}H_{32}O_2$ . Linolein, the glyceride of linoleic acid, is considered the drying constituent, which upon exposure is converted into oxylinoleic acid hydrate, and finally into linoxyn,  $C_{32}H_{54}O_{11}$ , which is insoluble in ether, and very soon forms in the boiled oil. The oil expressed with heat is darker, of stronger odor and more

FIG. 209.



Flaxseed : a, entire, magnified 3 diam. ; b, transverse section near the edge, magnified 65 diam.

acid taste. *Impurities* : Free acid, non-drying oils, mineral oils, rosin, rosin oils. Should be kept in well-stoppered containers, and that which has been "boiled" should not be used or dispensed. Dose,  $\bar{5}$ ss–2 (15–60 Cc.).

*PREPARATIONS*.—OIL : 1. *Sapo Mollis*. Soft Soap. (Syn., Sapo Viridis, Green Soap; Fr. Savon (mou) vert; Ger. Sapo kalinus, Kaliseife, Grüne seife.)

*Manufacture* : Dissolve potassium hydroxide 95 Gm. in water 450 Cc., heat to  $70^{\circ}$  C. ( $158^{\circ}$  F.), add it to linseed oil 400 Gm., mix thoroughly, incorporate alcohol 40 Cc., heat until mixture is soluble in boiling water without separation of oily drops. This is potassium oleate, as common soap is sodium oleate; it is a soft unctuous mass, brownish-yellow, characteristic odor, alkaline taste, soluble in 5 parts hot water, 2 alcohol.

*Prep.* : 1. *Linimentum Saponis Mollis*. Liniment of Soft Soap. (Syn., Tinctura Saponis Viridis, Spiritus Saponis Kalinus Hebra; Fr. Teinture de Savon vert; Ger. Hebra's Seifenspiritus.)

*Manufacture* : Dissolve oil of lavender flowers 2 Cc. in alcohol 30, to this add soft soap 65 Gm., agitate, let stand, filter, adding alcohol q. s. 100 Cc.; used externally.

**ERYTHROXYLACEÆ.**

2. *Ceratum Resinæ Compositum*, 13.5 p. c. 3. *Linimentum Calcis*, 50 p. c. 4. *Liquor Cresolis Compositus*, 35 p. c.

*Unoff. Preps.*: SEED. *Infusion*, 5 p. c. *Compound Infusion*, 5 p. c. + licorice root 2 p. c. These were once official and are effective from the dissolved mucilage of the epithelium (testa), which is altered starch. Dose, *ad libitum*. *Decoction*, 5 p. c. *Poultice*.

PROPERTIES.—Demulcent, emollient, diluent, diuretic.

USES.—*Infusion* or tea for inflammation of mucous membranes of respiratory, digestive, and urinary organs, renal and vesical irritation. catarrh, dysentery, calculi, strangury. *Decoction*, owing to the oil it contains, is less acceptable to the mouth, but all the better for enema. *Poultice* of ground meal to enlarged glands, swellings, boils, pneumonia, etc., made by adding boiling water to meal for proper consistency. Should coat skin with glycerin, olive or other oil before applying, and place as closely to affected spot as possible; may cover with oiled silk to retain heat and moisture, and may add olive oil, laudanum or any anodyne, stimulating, or astringent solution to poultice. The oil is laxative (3j; 30 Cc.), excellent in piles (3j–2; 30–60 Cc. night and morning); sometimes it is added to purgative enemata, also to cover erysipelatous and irritated skin surfaces, but with the disadvantages of soon drying (thus rendering skin stiff) and becoming sour and irritating. The *linimentum calcis* is applied to recent burns to allay irritation.

*Allied Products:*

1. *Flaxseed Cake, Oil-cake*.—Flaxseed when ground yields cake-meal, and this, after being deprived of oil, becomes oil-cake; it still contains all of the nitrogen, 4–5 p. c., and, moreover, a little oil, thus serving well as a cattle food; yields ash 5–8 p. c.

2. *Boiled Linseed Oil*.—Obtained by heating oleum lini to 130° C. (266° F.), while passing a current of air through it, when it boils, losing 6–8 p. c. by weight; or may heat and add litharge, red lead, manganese dioxide, lead acetate or manganous borate, thereby increasing the drying properties of the oil. It is darker in color, thicker, and dries faster, hence useful in painting, varnishing, etc., but must never be used in liniments as a substitute for the official ("raw") oil, since irreparable injury might be occasioned to burns, etc.

3. *Flax Liber-fibres*.—These furnish linen, which, when scraped, gives lint, while the primitive short fibre is useful as tow.

**42. ERYTHROXYLACEÆ. Coca Family.**

Er-i-throx-sil-a'se-e. L. *Erythroxylon* + aceæ, fr. Gr. ερυθρόν, red, + ξύλον, wood—i. e., some species have red wood. Shrubs, trees. Distinguished by flowers regular, small, calyx 5-lobed, petals 5, stamens 10, ovary 1–3-celled, superior; fruit drupe; temperate climates, tropics; stimulant, tonic, narcotic, dye.

Genus: 1. *Erythroxylon*.

## COCA. COCA.

**Erythroxyton** { *Coca*, *Lamarck*,  
*truxillense*, *Rusby*. } The dried leaves, containing 0.5  
p. c. ether-soluble alkaloids.

*Habitat.* Peru, Bolivia, Ecuador (Colombia, Brazil, India, Ceylon, Java); cultivated.

*Syn.* Erythroxyton, Spadic, Coca leaves, Cuca, Hayo, Ipado; Br. *Cocæ Folia*; Fr. *Coca, Feuilles de Coca*; Ger. *Coca blätter*.

*Er-y-throx'y-lon.* L. see etymology, page 341, of Erythroxyaceæ.

*Co'ca.* Sp. from native name, meaning tree or plant, *par excellence*.

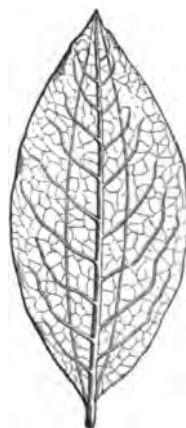
*Tru-xil-len'se.* L. Truxillian, of or belonging to Truxillo, coast city of N. Peru—i. e., whence it enters market.

**PLANT.**—Shrub 1–2 M. (3–6°) high, with many spreading, purplish-brown branches, wrinkled bark, twigs smooth; flowers yellow, small, petals 5; stamens 10; fruit reddish drupe, oval, 12 M. ( $\frac{1}{2}$ ') long, sarcocarp scanty. **LEAVES** (*Erythroxyton Coca*), oval-elliptical, 2.5–7.5 Cm. (1–3') long, 2–4 Cm. ( $\frac{1}{2}$ –1 $\frac{3}{4}$ ') broad, greenish-brown or

FIG. 210.

*Erythroxyton Coca.*

FIG. 211.

leaf: underside,  
usual size.

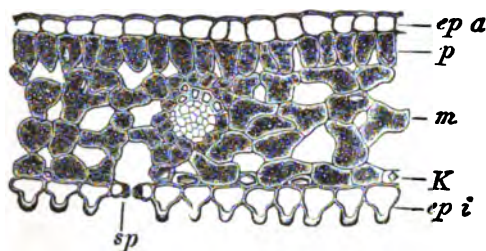
clear brown, smooth, slightly glossy and coriaceous, shortly petioled, base very short and abruptly narrowed, entire, midrib prominent underneath, with conspicuous line of collenchyma tissue running longitudinally on either side, one-third the distance between it and the margin, the enclosed areola of slightly different color; odor characteristic; taste bitterish, faintly aromatic, followed by numbness of tongue, lips, and fauces; powder yellowish-green; (*Erythroxyton truxillense*), ovate-oblongate, 1.6–5 Cm. ( $\frac{1}{2}$ –2') long, one-third to one-half as broad,

**ERYTHROXYLACEÆ.**

pale green, thin, brittle, usually much broken, smooth, not shining, petiole short and stout, slight, point at apex, entire, the two collenchyma lines underneath usually incomplete or obscure; odor more tea-like than preceding; taste and numbing effect similar; powder pale green. *Solvent*: diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—Leaves that are smudgy brown or with dull surface, also small jaborandi leaves, sometimes to the extent of 40–50 p. c., Inga and Pacay flowers by accident.

FIG. 212.



Coca leaf, cross-section: *ep a*, upper epidermis; *p*, palisade layer; *m*, spongy parenchyma (in the centre a small fibrovascular bundle); *K*, a crystal, magnified 160 diam.: *ep i*, epidermis of lower side with papilla and a stoma (*sp*).

**Commercial.**—Coca, although not introduced into England until 1870, was used by the aborigines in S. America prior to the Spanish conquest. They used it in religious services, and spoke of it as a God-given plant, satisfying hunger, strengthening the weak, and banishing man's misfortunes. The invaders, not being in sympathy with

FIG. 213.



Coca leaf: Epidermis of lower side with the papillæ and stomata seen from above, magnified 160 diam.

such homage, forbade its use and cultivation until they observed that it enabled the conquered to do more work for them. Neither of the species is the same wild as under cultivation, and escaping this, soon degenerate and show marked changes in leaf-characteristics. It is largely cultivated in the Andes on terraced plantations (*cocales*) cleared from the forests on the warm declivities, and thrives best where there

are a few scattered shade trees, but deep shade develops bitterness, as do low elevations; it requires a moist atmosphere, consequently any variation therefrom, as well as of soil, exposure, curing, etc., may affect the quality. The plant is propagated as our peach, yielding at the second year and continuing for fifty. Leaves, when bright green above and yellow-green below, are picked carefully to avoid breaking them or injuring the young leaf-buds, which form the second crop; they are removed in baskets, spread on unroofed floors and dried quickly for a few hours in the sun (if too rapidly, lose odor and green color; if too slowly, acquire disagreeable odor and taste). After lying in loose piles in the coca-house 2-3 days, they again are exposed for a short period to the sun to dry off the sweat that has developed, then compressed into bales (*cestos*) 25-50 pounds (11.6-23.3 Kg.), or tin-lined boxes better, to prevent deterioration in transportation, which sometimes results from fermentative decomposition. There are 2-3 harvests yearly, the Sept. being best, the April next, each yielding 60-80 pounds (27-37 Kg.) per acre when dry; the collection, however, is almost continuous in some localities. The annual yield is about 80,000,000 pounds (37,383,177 Kg.), largely exported from Huanuco, Lima, Truxillo, etc. Leaves begin to deteriorate as soon as fully dried, irrespective of how carefully cured or kept, and should not be used after a few months, as their cocaine will be found to have decreased very materially, and the more so in the presence of dampness. There are two commercial varieties: 1. *Huanuco, Cuzco*, after the cities of S. Peru (*Erythroxylon Coca*). This is grown mostly in Bolivia and S. Peru, thriving best and yielding the best product at 1,050-1,800 M. (3,500-6,000°), in 18° south, and giving inferior grades at lower elevations. The true Bolivian coca has the larger fruit, smaller leaves, is the best; seldom exported, being consumed at home. 2. *Truxillo, Trujillo*, after the N. Peru coast city (*Erythroxylon truxillense*). This is grown more northward, thriving well at lower elevations, and is the kind preferred by the natives for chewing. Java and India coca (*Erythroxylon Coca*, var. *Spruceanum*) is identical with this variety, but owing to inferiority is not exported.

CONSTITUENTS.—Cocaine 0.4-0.8 p. c. (Huanuco), 0.25-0.6 p. c. (Truxillo), cinnamyl-cocaine, truxil-cocaine (truxilline, isatropyl-cocaine, cocamine),  $C_{19}H_{23}NO_4$ , ecgonine, coca-tannic acid, wax, volatile oil; hygrine is doubted by some, while cocainidine, probably isomeric with cocaine, but weaker, has not yet been studied thoroughly.

**Cocaina, Cocaine** (*methyl-benzoyl-ecgonine*),  $C_{17}H_{21}NO_4$ , *official*.—(Syn., Br. Cocaina; Fr. Cocaine; Ger. Cocainum, Cocain.) An alkaloid, consisting of methyl alcohol, benzoic acid, and ecgonine,  $C_8H_{15}NO_3$ , into which it separates by heating with strong hydrochloric acid. Obtained by moistening leaves with solution sodium hydroxide, treating with benzin, from which the alkaloids, as salts, can be transferred to diluted sulphuric acid by agitation; upon adding excess solution sodium hydroxide the lesser alkaloids and cocaine are precipitated (hygrine, etc., remaining in solution); cocaine can now be separated by filtering

**ERYTHROXYLACEÆ.**

and expressing, and purified by crystallizing from alcohol. It is in large, colorless, 4-sided or 6-sided monoclinic prisms, slightly bitter taste, producing on the tongue temporary numbness, soluble in chloroform, benzene, carbon disulphide, 5 parts alcohol, 3.8 ether, 600 water, 14 oil of turpentine, 12 olive oil, insoluble in glycerin, no residue; forms salts (hydrochloride, nitrate, sulphate, etc.).

**Cocainæ Hydrochloridum, Cocaine Hydrochloride,  $C_{17}H_{21}NO_4 \cdot HCl$ , official.**—(Syn., Cocainæ Hydrochloras, U. S. P. 1890, Cocaine Hydrochlorate; Fr. Chlorhydrate de Cocaine; Ger. Cocainum hydrochloricum, Cocainhydrochlorid.) Obtained by dissolving the pure alkaloid in alcoholic solution of hydrochloric acid, setting aside to crystallize, or precipitating with ether. It is in colorless, transparent, monoclinic prisms, flaky, lustrous leaflets or white crystalline powder, permanent, without water of crystallization; odorless, saline, slightly bitter taste, producing on the tongue tingling sensation, followed by numbness lasting several minutes, soluble in 0.4 part water, 2.6 alcohol, 18.5 chloroform, insoluble in benzene, petroleum benzin, ether, neutral, levogyrate, no residue. *Tests*: 1. Chromium trioxide gives yellow precipitate, dissolved upon shaking; now add hydrochloric acid, get permanent orange-colored, crystalline precipitate. 2. Mercuric chloride T. S. gives white flocculent precipitate. 3. Potassium permanganate gives violet precipitate, appearing brownish-violet when collected on filter; crystal dissolved in alcohol + piece of potassium hydroxide gives odor of ethyl benzoate. *Impurities*: Cinnamyl-cocaine, isatropyl-cocaine. This salt is dispensed generally under the name of cocaine, usually in (hypodermic) solutions of 2, 4, 5, 10 p. c. Dose, gr.  $\frac{1}{8}$ –2 (.008–.13 Gm.).

**Hygrine,  $C_{12}H_{13}N$ .**—Some claim this not to be a constituent of coca, others that it is obtained from the solvent used in the separation of the other alkaloids, and that it is a volatile, aromatic liquid alkaloid, yellow, burning taste, odor of trimethylamine, soluble in water, alcohol, ether, aqueous solutions of salts fluorescent.

**Assay**: Exhaust 10 Gm. powdered coca with alkaline (ammonia 2 Cc.) solution of chloroform (1) and ether (4) q. s. 50 Cc., shake out tincture with normal sulphuric acid V. S. (6, 10, 10), draw off acid liquid, neutralize with ammonia water, shake out with ether 25, 20, 15, evaporate ethereal alkaloidal solution to dryness, add 4 Cc.  $\frac{N}{10}$  sulphuric acid V. S. + 5 drops hæmatoxylin or iodeosin T. S., titrate excess of acid with  $\frac{N}{50}$  potassium hydroxide V. S., of latter divide number of Cc. used by 5; subtract this from 4, multiply remainder by 0.03, and product by 10 = p. c. of ether-soluble alkaloids present.

**PREPARATIONS.**—I. **LEAVES**: 1. *Fluidextractum Cocæ*. Fluid-extract of Coca. (Syn., Extractum Cocæ Fluidum, U. S. P. 1890; Br. Extractum Cocæ Liquidum; Fr. Extrait liquide de Coca; Ger. Flüssiges Cocablätterextrakt.)

**Manufacture**: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.5 Gm. of ether-soluble alkaloids. **Assay**: To 10 Cc., add ether

25 Cc., ammonia water 2, shake, draw off lower aqueous layer and shake it again with ether 20, shake out ether solutions with normal sulphuric acid V. S., and proceed approximately as in assay of coca. Dose, 3ss–2 (2–8 Gm.).

Prep.: 1. *Vinum Coca*. Wine of Coca. (Syn., *Vinum Erythroxyli*, Wine of Erythroxyton.)

*Manufacture*: Dissolve sugar 6.5 Gm. in red wine (claret) 50 Cc., add alcohol 7.5, fluidextract of coca 6.5, then red wine q. s. 100 Cc., filter after standing several days. Dose, ʒij–4 (8–15 Cc.).

II. COCAINE: 1. *Oleatum Cocainæ*. Oleate of Cocaine. (Syn., *Cocainum Oleicum*; Fr. *Oleate de Cocaine*; Ger. *Cocainoleat*.)

*Manufacture*: Triturate cocaine (alkaloid) 5 Gm. with alcohol 5 Cc., add oleic acid 2 Gm., warm mortar, stir until alcohol evaporated, add oleic acid 48 Gm., stir until cocaine dissolved, add olive oil q. s. 100 Gm.; oleates of aconitine, morphine, strychnine, etc., may be made in similar manner. Used externally.

*Unoff. Preps.*: I. LEAVES: *Tincture*, 20 p. c. (diluted alcohol), dose, ʒj–4 (4–15 Cc.). *Infusion*, dose, ʒj–2 (30–60 Cc.). II. COCAINE: *Oleate of Cocaine*, 10 p. c. *Injectio Cocainæ Hypodermica* (Br.), 10 p. c. *Lamellæ Cocainæ* (Br.),  $\frac{1}{80}$  gr. (.0013 Gm.). *Unguentum Cocainæ* (Br.), 4 p. c.

PROPERTIES.—Cerebral stimulant, bitter tonic, diuretic, mydriatic, diaphoretic, anaphrodisiac, narcotic. Locally, has no action upon the unbroken skin, but acts upon mucous membranes and subcutaneous tissue as anæsthetic and analgesic, producing also its constitutional effects. It increases digestion, respiration, heart action, temperature, arterial tension, and the irritability of the sensory nerves, followed by mental, moral, and muscular depression. It anæsthetizes the gastric mucous membrane, thereby temporarily deadening the sensations of hunger and thirst, which, however, seem all the greater as the effects of the drug wear off; the brain is stimulated by increasing the blood supply, producing wakefulness, a sense of hilarity and well-being (similar to *cannabis indica*), increased muscular strength and endurance. Acts as a diuretic by checking waste processes, lessening the quantity of urea, but increases that of urine; dilates the pupil by stimulating the ends of sympathetic nerve in the iris. When full amount is chewed one works cheerfully as long as the effect lasts, irrespective of meal hour, which may continue 3–4 days from repeated doses—usually, however, food is taken at night, and only the meal of mid-day bridged over. Natives drink its tea like Chinese tea elsewhere, and carry a bag of leaves and one of ashes or lime; after forming a quid of the leaves deprived of ribs (ʒj; 4 Gm.), a little ash or lime is added to give pungency and to aid the secretion of saliva; each chew lasts an hour, when a new one follows. Cocaine, in general action, resembles atropine; causes little injury to natives, but strangers soon become haggard-looking and idiotic.

USES.—In melancholia, epilepsy, spinal paralysis, insanity, diabetes, headache, typhoid state, opium-habit, uterine inertia, cholera morbus, spermatorrhœa, debility, poisoning by hydrated chloral, opium, or

**ZYGOPHYLLACEÆ.**

bromides. Locally, to burns, painful ulcers, fissures of anus, hay fever, sore throat, laryngitis, hemorrhoids, bronchitis, coryza, and in surgical operations. No more than gr.  $\frac{1}{4}$  (.045 Gm.) should be applied at once.

*Poisoning*: Have nervous excitement, oppression, and fulness of head, sometimes nausea and vomiting, pulse and respiration at first rapid, then slow, breathing labored, face cyanotic, pupils dilated, extremities cold, convulsions, coma, death; may have early delirium and unconsciousness, or only asphyxia. Place in horizontal position and fresh air, empty stomach, stimulants—amyl nitrite, caffeine, atropine, oxygen and ammonia inhalations; hydrated chloral (gr. 30–60; 2–4 Gm.), paraldehyde, sulphonal, chloroform, ether or morphine injections; strychnine, artificial respiration, nitroglycerin. Chronic poisoning (*cocainism* or *habît*) is nearly as degenerative and serious as that of opium, and may be treated similarly, but usage does not create nerve irritation to the same extent, consequently one with a strong will power may desist abruptly its use without suffering other than the want of mental satisfaction and pleasures the craving for which it tends to establish.

*Incompatibles*: Alkalies, alkaline carbonates and bicarbonates, mercuric chloride, iodine, iodides, ammonia, zinc chloride, borax.

*Synergists*: Cerebral effects—alcohol, cannabis indica, belladonna; analgesic—atropine, phenol (carbolic acid), conium, opium; mydriatic—atropine.

**43. ZYGOPHYLLACEÆ. Guaiacum or Bean-caper Family.**

Zi-go-fi-la'se-e. L. *Zygophyllum* + aceæ, fr. Gr. ζυγόν, yoke, + φύλλον, leaf—i. e., leaves foliolate, yoked and in pairs. Herbs, trees, shrubs. Distinguished by flowers, white, red, yellow, with fleshy disk; sepals 5, free, glandless; petals 4–5, filaments 8–10, having small scales; ovary lobed, 4–12-celled, superior, 2 filiform ovules in each, little or no albumin; beyond tropics; stimulant, alterative, diaphoretic, anthelmintic; wood hard, durable.

Genus: 1. **Guaiacum** (**Guajacum**).

**GUAIAIACUM. GUAIAIAC.**

**Guaiacum** { **officinale**, *Linné*, } The resin of the wood.  
                  { **sanctum**, *Linné*. }

*Habitat*. 1. West Indies, South America (Jamaica, Haiti, Cuba, Columbia, Venezuela). 2. West Indies (Cuba, Bahamas, Florida).

*Syn*. Lignum Vitæ, Sanctum or Benedictum, Rockwood, Pockwood; Fr. Gaïac, Gayac, Bois de Gayac; Ger. Lignum Guajaci, Guajakholz, Franzosenholz, Pockholz; Fr. Résine de Gayac; Ger. Resina Guajaci, Guajakharz, Guajak.

**Guai'a-cum**. L. fr. Sp. *guayaco*, *guayacan*—i. e., plant's native Haitian name.

**Of-fi-ci-na-le**. L. see etymology of (*Rheum officinale*, page 177).

**Sanctum**. L. *sanctus*, *sancere*, consecrate—i. e., used as incense in worship.

**Guai'ac**. The correct S. American name of the tree.



PLANTS.—1. *Guaiacum (Guajacum) officinale*.—This is a tree 6–12 M. (20–40°) high, trunk .3–.5 M. (1–1½°) thick, branches knotty, stem-bark ash-gray, striated, variegated with greenish or purplish spots; leaves 7.5 Cm. (3') long, evergreen, paripinnate, 2–4 pairs; leaflets obovate, 2.5–4 Cm. (1–1½') long; flowers large, blue, 4–10, in axils of upper leaves; sepals 5; petals 5; stamens 10, about 18 Mm. (¾') long; fruit capsule, 2-celled, each 1-seeded (black), obcordate. 2. *Guaiacum (Guajacum) sanctum*.—Tree 6–9 M. (20–30°) high; leaflets narrower, mucronate; fruit 5-celled, seeds red; wood of both species consists of sap and heart, the latter heavier than water, sp. gr.

FIG. 214.

*Guaiacum sanctum.*

1.30, very hard, brown or greenish-brown, resinous, sap yellowish, with heat emitting balsamic odor, taste slightly acrid; in shops as raspings. RESIN (guaiac), in irregular masses, greenish-gray brown, brittle, fracture with glossy lustre, in recent guaiac yellowish-green or reddish-brown, transparent in thin splinters, fusible, sp. gr. 1.20, melts at 85° C. (185° F.); odor balsamic; taste slightly acrid; powder grayish, turning green on exposure. Tests: 1. At least 85 p. c. soluble in alcohol, which solution ferric chloride tincture colors blue. 2. Filtrate from macerating with 4–5 times its weight of petroleum benzin

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should be colorless, and not give green color with cupric acetate solution (1 in 1,000—abs. of rosin); ash 4 p. c. *Solvents*: alcohol; acetone; chloroform, ether, alkalies; the former solution blue with tincture ferric chloride, chlorine, chromic acid, and other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.).

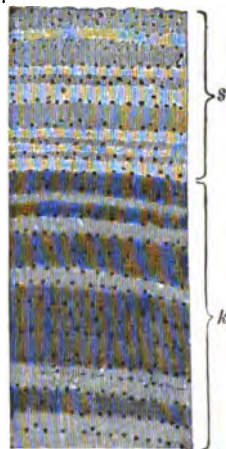
**ADULTERATIONS.**—Owing to careless collecting may contain admixtures 10, 15, 30 p. c.; thus *rosin* (heat for odor, or oil of turpentine will dissolve its own resin, leaving guaiac untouched), *damar* (80–90 p. c. soluble in benzin), *Peru guaiac resin* (42 p. c. soluble in benzin), *Carana resin* (alcoholic solution not precipitated by lead acetate), also *bark*.

**Commercial.**—The best *lignum vitæ* (wood of life—i. e., its virtues thought to prolong life) comes from St. Domingo in logs several feet long, with adhering gray bark, showing on edges shining crystals of calcium sulphate; the bark and yellow sapwood are removed and the dark, hard heartwood is turned and shaped into various implements, etc., the wastings being reserved for medicine. The finest resin is also from St. Domingo, although very good comes from Jamaica and Haiti ports; the wood contains of this 20–25 p. c., which is obtained: (1) As a natural exudation; (2) by incisions made into the bark; (3) by logs being scarified in the middle, then suspended horizontally in the air by two uprights and fire applied at both ends, whereby melted resin runs out from the centre into calabash cups.

**CONSTITUENTS.**—Guaiaretic acid,  $C_{20}H_{26}O_4$ , 10 p. c., Guaiaconic acid (alpha-resin),  $C_{19}H_{20}O_5$ , 50–70 p. c., Guaiac beta-resin 10 p. c., gum 4–9 p. c., guaiacic acid, guaiac-yellow. Last two are crystalline, and may be dissolved out by milk of lime; if residue is now treated with hot alcohol, evaporated, and this residue in turn dissolved in hot solution sodium hydroxide, the sodium salt of guaiaretic acid crystallizes out, while the mother-liquor contains guaiaconic acid and guaiac beta-resin, which, after removing alkali, are separated by ether, the latter being insoluble. Guaiaretic acid has a faint vanilla odor, is crystalline, not blue with nitric acid; guaiaconic acid is amorphous, colored blue by nitric acid and other oxidizing agents, guaiac-yellow occurs in pale yellow quadratic octahedra, having a bitter taste. By dry distillation of guaiac get: 1. *Guaiacene*,  $C_5H_8O$  (odor of bitter-almond). 2. *Guaiacol*,  $C_7H_8O_2$  (a colorless aromatic oil, green, with ferric chloride). 3. *Creosol*,  $C_8H_{10}O_2$  (resembles guaiacol). 4. *Pyroguaiacin*,  $C_{18}H_{18}O_3$  (in inodorous scales, green by ferric chloride, blue with warm sulphuric acid).

**PREPARATIONS.**—1. *Tinctura Guaiaci*. Tincture of Guaiac. (Syn., Fr. Teinture de Résine de Gaïac; Ger. Tinctura Guajaci, Guajaktinktur.)

FIG. 215.



Guaiacum wood: cross-section, magnified 4 times; k, heartwood; s, sapwood.

*Manufacture*: 20 p. c. Macerate 3 days, frequently agitating, 20 Gm. with alcohol q. s. 100 Cc., filter. Dose, ℥v-60 (.3-4 Cc.).

2. *Tinctura Guaiaci Ammoniata*. Ammoniated Tincture of Guaiac. (Syn., *Tinctura Guaiaci Composita*; Fr. *Teinture de Gaïac ammoniacale*; Ger. *Ammoniakalische Guajak tinktur*.)

*Manufacture*: 20 p. c. Macerate 3 days, frequently agitating, 20 Gm. with aromatic spirit of ammonia q. s. 100 Cc., filter. Dose, ℥v-30 (.3-2 Cc.).

*Unoff. Preps.*: *Mistura Guaiaci* (Br.), 2.5 p. c., dose, ℥iv-8 (15-30 Cc.). *Trochiscus Guaiaci Resinæ* (Br.), 3 gr. (.2 Gm.). *Syrup*.

**PROPERTIES.**—Alterative, diaphoretic, expectorant, stimulant, antiseptic, astringent. Stimulates the flow of saliva, bronchial mucus, bile, and gastric juice, causing sometimes vomiting and purging; increases heart force and rapidity, dilates cutaneous bloodvessels, and large doses contract uterus. It is eliminated by bowels, kidneys, bronchi, but chiefly kidneys.

**USES.**—The wood, owing to its variability, is now seldom used in medicine; was employed first in Europe 1508, and the Spaniards prized it highly at that period and since, for syphilis, rheumatism, gout, scrofula, skin eruptions. Its great service is in furnishing resin, and (owing to its hardness, toughness, density, and durability) for making pestles, blocks, pulleys, rulers, skittle and bowling balls, hawser bearings, etc.

The resin, although very strong, is becoming less used, being replaced by the more powerful chemical alteratives such as potassium and sodium iodides, etc. Useful in rheumatism, gout, lumbago, syphilis, scrofula, skin eruptions, amenorrhœa, dysmenorrhœa, diphtheria, tonsillitis (quinsy). Guaiacol often is substituted for creosote in phthisis, coughs, etc. Dose, ℥j-4 (.06-.26 Cc.).

*Incompatibles*: Spirit of nitrous ether, mineral acids, water.

*Synergists*: Sarsaparilla, stillingia, mezereum, sassafras, other diaphoretics, and some diuretics.

*Allied Plant*:

1. *Guaiacum angustifolium*.—S. Texas, Mexico. Wood hard, heavy, splitting irregularly, yellowish-brown. Sometimes substituted for that which formerly was official.

#### 44. RUTACEÆ. Rue Family.

Ru-ta'se-e. L. *Rut-a* + *aceæ*, fem. pl. of *rutaceus*, of or resembling rue, fr. Gr. *ῥοτή*, *ῥώω*, to flow—i. e., referring to medicinal properties (female). Trees, herbs, shrubs. Distinguished by leaves exstipulate, dotted with pellucid glands, containing aromatic volatile oil; sepals 4-5; petals 4-5, imbricated; ovary connate or united by base, style, or stigma, superior; stamens distinct, equal or double the petals; albuminous or exalbuminous; tropics; antispasmodic, tonic, febrifuge, diuretic.

Genera: 1. *Xanthoxylum*. 2. *Pilocarpus*. 3. *Barosma*. 4. *Citrus*.

## RUTACEÆ.

## XANTHOXYLUM. XANTHOXYLUM.

*Xanthoxylum americanum*, Miller, } The dried bark.  
*Fagara Clava-Herculis*, (Linné) Small. }

*Habitat.* North America. 1. Canada to Virginia and North Carolina; rocky woods, river banks. 2. Virginia to Florida, westward to Texas; sandy coast, dry soil.

*Syn.* Prickly Ash. 1. Northern Prickly Ash, Angelica Tree, Pepper or Yellow Wood, Pellitory or Toothache Bark or Tree. 2. Southern, West India or Yellow Prickly Ash, Sea Ash, Pepper-wood, Hercules' Club, Yellow Hercules, Prickly Yellow Wood; Fr. Clavallier, Frêne épineux; Ger. Zahnweh(holz)rinde.

*Xan-thox'y-lum.* L. fr. Gr. *ξανθός*, yellow, + *ξύλον*, wood—i. e., roots are yellow.

*Fa-ga'ra.* L. The Arabic name of genus.

*A-mer-i-ca'num.* L. belonging to America, American.

*Cla'va-Her'ou-lis.* L. *clava*, club, + *Hercules*—i. e., resemblance of cone-like warts.

PLANTS.—1. *Xanthoxylum americanum*, Northern Prickly Ash. Shrub 2–4 M. (6–12°) high, covered with sharp scattered prickles; leaves imparipinnate, leaflets 4–5 pairs, ovate, downy; flowers April–May, before the leaves, yellowish-green, sessile, umbels, polygamous, sepaloïd; fruit capsule, oval, punctate, greenish-red, 2-valved, 1 black seed. 2. *Fagara Clava-Herculis*, Southern Prickly Ash. Small tree 6–12 M. (20–40°) high, bark with prickles protruding through large corky cones, larger prickles on branches and petioles; leaflets 3–8 pairs, crenate, unequal-sided, shining; flowers June, after leaves appear, cymes. BARK (*Xanthoxylum americanum*), in curved or quilled fragments, 1 Mm. ( $\frac{1}{8}$ ') thick, brownish-gray, with whitish patches, minute black dots, faintly furrowed, with some brown, glossy, straight, 2-edged spines, linear at base, 5 Mm. ( $\frac{1}{8}$ ') long, inner surface whitish, smooth, fracture short, non-fibrous, green in outer, yellowish in inner layer; inodorous; taste bitterish, very pungent; (*Fagara Clava-Herculis*), in very large quills or sheets, 1–2 Mm. ( $\frac{1}{8}$ – $\frac{1}{2}$ ') thick, light purplish-gray with large silvery-gray patches, marked by many large corky projections, often 2 Cm. ( $\frac{1}{2}$ ') high, with stout brown spines; otherwise similar to *X. americanum*; neither should be confounded with *Ara'lia spino'sa*, Hercules' Club, bark of which is nearly smooth externally, but that of stem is beset with very sharp, slender prickles in transverse rows. *Solvents*: alcohol; boiling water. Dose, gr. 10–30 (.6–2 Gm.).

CONSTITUENTS.—Similar in both barks but not identical: Resins (2), Bitter principle (xanthoxylin-e), volatile oil (acid, green), tannin, sugar, ash 12 p. c.

Resins.—One crystalline, white, tasteless, bitter in alcoholic solution; the other soft, acrid, constituting the brownish powder, *xanthoxylin*, resinoid of the "Eclectics." Dose, gr. 1–2 (.06–.13 Gm.).

Bitter Principle (*xanthoxylin-e*).—Probably an alkaloid identical with berberine; with sulphuric acid brown and dark red.

PREPARATIONS.—1. *Fluidextractum Xanthoxyli*. Fluidextract of *Xanthoxylum*. (Syn., Extractum Xanthoxyli Fluidum, U. S. P. 1890; Fr. Extrait liquide de Frêne épineux; Ger. Flüssiges Zahnweh-rindenextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose,  $\text{m}\bar{x}$ –30 (.3–2 Cc.).

**Unoff. Preps.:** *Extract*, dose, gr. 3–10 (.2–.6 Gm.). *Decoction*, 5 p. c., dose,  $\bar{z}$ ss–2 (15–60 Cc.).

**PROPERTIES.**—Alterative, stimulant, sialagogue, emmenagogue, diaphoretic, diuretic, causes salivation, tingling in tongue, increases cardiac action and arterial tension, also secretion from stomach, intestines, liver, and pancreas; resembles mezereum, guaiac, sanguinaria, and stillingia in action.

**USES.**—Chronic rheumatism, myalgia, lumbago, dropsies, atonic dyspepsia, syphilis, pharyngitis, as a masticatory for toothache, tongue paralysis. Externally as a counter-irritant in female pelvic diseases.

*Allied Plants:*

1. *Xanthoxylum florid'anum*, *Satin Wood*.—Identical with *X. carib'æum*; *X. ptero'ta*, Florida, Texas, Brazil; wood yellow, hard; bark and leaves pungent.

FIG. 216.



Angustura bark: one-half natural size.

2. *Cuspariæ Cortex*, *Cusparia Bark* (Br.), *Angustura*.—The bark of *Cuspa'ria Angostu'ra* (*Galipe'a Cusparia*); official 1820–1880. Northern South America. Tree 4.5–6 M. (15–20°) high, leaves with 3 leaflets, 15–25 Cm. (6–10') long, 5–10 Cm. (2–4') broad, spotted white, tobacco odor, flowers white; bark in flat, curved, or quilled pieces 2.5 Mm. ( $\frac{1}{10}$ ') thick, ochrey-gray, friable periderm, inside cinnamon-red, striæ of calcium oxalate, aromatic, bitter; contains volatile oil, resin, angusturin, 4 alkaloids. Used for diarrhœa, dysentery, dyspepsia, typhoid, stimulant, febrifuge, large doses emetic; in infusion, tincture, extract. Dose, gr. 10–30 (.3–2 Gm.).

False Angustura Bark (*Strychnos Nux-vomica*) has stone-cells, no striæ of calcium oxalate; is very bitter, not aromatic, contains strychnine, brucine.

## PILOCARPUS. PILOCARPUS.

**Pilocarpus** { *Jaborandi*, Holmes, } The leaflets, containing 0.5 p. c. of  
                  { *microphyllus*, Stapf. } alkaloids.

**Habitat.** 1. Brazil, near Pernambuco; 2. Brazil, near Maranh; Paraguay, Uruguay; in forest-cleanings on the hill-slopes.

**Syn.** *Jaborandi*, *Pilocarpi Foliata*; Br. *Jaborandi Folia*; Fr. *Jaborandi*; Ger. *Folia Jaborandi*, *Jaborandiblätter*. 1. Pernambuco *Jaborandi*. 2. Maranh *Jaborandi*.

**Pi-lo-car'pus.** L. *pilus*, hair, or fr. Gr.  $\pi\acute{\iota}\lambda\omicron\varsigma$ , a cap, +  $\kappa\alpha\rho\acute{\iota}\varsigma$ , fruit—i. e., fruit hat-shaped.

**Jab-o-ran'di.** L. fr. Port. *zha-bo-ran-de'*—i. e., South American name.

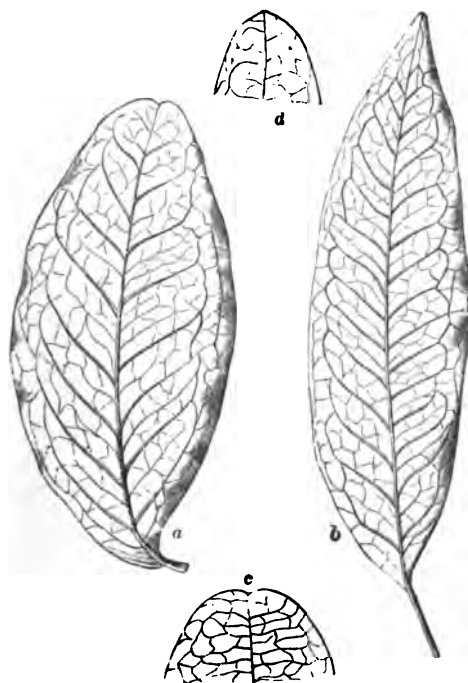
**Mi-cro-phyll'us.** L. fr. Gr.  $\mu\acute{\iota}\kappa\rho\acute{\varsigma}$ , small, +  $\phi\acute{\iota}\lambda\lambda\omicron\nu$ , leaf—i. e., having small leaves.

**PLANTS.**—Shrubs 1.2–1.5 M. (4–5°) high, branches erect; bark smooth, with gray and white dots, root 18 Mm. ( $\frac{3}{4}$ ') thick; flowers small, pinkish-purple, pedicellate, racemes 45 Cm. (18') long; fruit, 5 carpels 4 Cm. ( $1\frac{3}{4}$ ') long, compressed, curved ridges dotted with oil-glands, carpels 1-seeded, reniform, black; leaves imparipinnate, .3–.4 M.

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(1-1½°) long, 2-5 pairs. LEAFLETS (*Pilocarpus Jaborandi*), 6-12 Cm. (2½-5') long, 2-4 Cm. (½-1¾') broad, short stout petiolule, oblong or oval, mostly unequal at base, blunt, emarginate, entire, narrowly revolute, yellowish-green, smooth, shining, coriaceous, reticulate venation prominent on both sides, especially beneath; strongly pellucid-glandular; peculiar aromatic when crushed; taste bitterish, salty, aromatic, pungent, sialagogue; (*Pilocarpus microphyllus*), 1.3-3.7 Cm. (½-1½') long, 0.8-1.6 Cm. (⅓-¾') broad, the lateral without petiolules, rhomboidally oval to obovate, acute base, blunt and unequally emarginate; the terminal on short margined petiolules, almost equally oval to obovate, narrower than lateral, thickish, rigid, entire, smooth, dull

FIG. 217.



*Pilocarpus Jaborandi*: variously shaped leaflets. *a* and *c*, emarginate; *b* and *d*, pointed, blunt.

green, finely pellucid-glandular; midrib stout, veins coarsely reticulate, lightly prominent; almost odorless; taste similar to preceding. *Solvents*: diluted alcohol; boiling water partially. Dose, gr. 15-30 (1-2 Gm.).

**ADULTERATIONS.**—Leaves of allied species and of some piperaceous plants; these latter may be distinguished by being thin, subcoriaceous, ovate, acuminate, finely granular, and not pellucid-punctate; also leaflets of one or more species of *Swartzia* for “*Maranham Jaborandi*,” being ovoid, short hairy petiole, upper surface shining, lower minutely hairy, not pellucid-punctate, some only 5 Mm. (½') long.

*Commercial*.—This plant was introduced into Europe in 1847, and is now cultivated. The names *Jaborandi*, *Jamborandi*, *Iaborandi*, are applied natively, in both generic and specific sense, to several dissimilar, pungent plants having sialagogue, diaphoretic, and sudorific properties as *Serro'nea Jaboran'di*, *Piper Jaborandi* (possibly the true *Jaborandi*), *P. unguicula'tum*, *P. citrifo'lium*, *P. reticula'tum*, *P. Mollico'mum*, *Erte'la* (*Auble'tia*) *trifo'lia*, *Xanthoxylum el'egans*. Leaves should be collected when grown, after rainy season, and inclining to mouldiness, should be thoroughly dried before packing. The official species are high-priced and scarce, consequently are subject to much substitution; *Rio Jaborandi* (*P. Selloanus*), once official and popular, continues to have a limited demand in spite of its great irregularity in characteristics and constituents.

**CONSTITUENTS**.—Pilocarpine 0.5–1 p. c., isopilocarpine, pilocarpidine, jaborine (?), volatile oil 0.5 p. c., (resin, tannin, malic acid, salts).

**Pilocarpine** (*Pilocarpina*),  $C_{11}H_{16}N_2O_2$ .—This liquid alkaloid, as first obtained under the name of jaborandine, was believed to be volatile, but this is not true, although it occurs as a colorless, syrupy liquid. It may be prepared by moistening powdered leaves with solution sodium carbonate, exhausting with warm benzene; shake out with diluted hydrochloric acid, after separation make acid solution alkaline with solution sodium carbonate, shake out with chloroform; evaporate chloroformic liquid getting residue of crude alkaloids, neutralize with diluted nitric acid, evaporate to dryness, purify by repeated crystallization from alcohol; dissolve pilocarpine nitrate in water, render alkaline with ammonia, shake out with chloroform, evaporate getting pure pilocarpine as a colorless syrupy liquid. It is soluble in water, alcohol, chloroform, slightly in ether, forms crystallizable salts (hydrochloride, nitrate, etc.); resembles nicotine in action.

**Pilocarpinæ Hydrochloridum, Pilocarpine Hydrochloride**,  $C_{11}H_{16}N_2O_2 \cdot HCl$ , *official*.—(Syn., *Pilocarpinæ Hydrochloras*, U. S. P. 1890; Fr. *Chlorhydrate de Pilocarpine*; Ger. *Pilocarpinum Hydrochloricum*, *Pilokarpinhydrochlorid*.) Prepared by neutralizing diluted hydrochloric acid (17.5) with pilocarpine (10), concentrating, setting aside over sulphuric acid to crystallize; occurs in colorless, transparent crystals, odorless, faintly bitter, deliquescent, soluble in 0.3 part water, 2.3 alcohol, 540 chloroform, no residue. *Tests*: 1. Dissolve 0.01 Gm. in 2 Cc. water + 2 Cc. slightly acid solution hydrogen dioxide, + small layer benzene, + 3–4 drops solution potassium dichromate (1 in 300), shake gently, when benzene layer acquires a violet color, the aqueous layer remaining yellow (dis. from other alkaloids). Should be kept in well-stoppered, amber-colored vials. Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.008–.03 Gm.), administered best hypodermically (2 p. c. aqueous solution).

**Pilocarpinæ Nitras, Pilocarpine Nitrate**,  $C_{11}H_{16}N_2O_2 \cdot HNO_3$ , *official*.—(Syn., Fr. *Nitrate de Pilocarpine*; Ger. *Pilocarpinum Nitricum*, *Pilokarpinnitrat*.) Prepared by neutralizing diluted nitric acid (121) with pilocarpine (40), evaporating to dryness, redissolving in alcohol, crystallizing; occurs in colorless shining crystals, odorless, faintly

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bitter, permanent, soluble in 4 parts water, 60 alcohol, insoluble in ether, chloroform, no residue. *Tests*: 1. Dissolves in sulphuric acid with colorless solution, + potassium dichromate get bright grass-green color. 2. Rubbing with equal quantity mercurous chloride yields no black color (dis. from pilocarpine hydrochloride). Should be kept in well-stoppered, amber-colored vials. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.), administered best hypodermically (2 p. c. aqueous solution).

**Isopilocarpine**.—Obtained by action of heat or alkali on pilocarpine; it is a colorless viscid oil, boiling at 261° C. (502° F.), distilling without decomposition, isomeric with pilocarpine; pilocarpidine,  $C_{10}H_{14}N_2O_2$ , found in *P. Jaborandi* but not in *P. microphyllus*, is a liquid body, differing from pilocarpine by auric chloride not precipitating aqueous solutions, in being weaker, deliquescent, oxidizing in air to syrupy jaboridine (possibly identical with jaborandine,  $C_{10}H_{12}N_2O_3$ ; jaborine,  $C_{12}H_{18}N_4O_4$ , is of doubtful occurrence, although formerly believed to be in the leaves and to be formed by evaporating acid solutions of pilocarpine; as such it was yellow, amorphous, less soluble in water, but more so in ether than pilocarpine, isomeric with it (same molecular formula), but antagonizing its action, resembling atropine; the commercial jaborine has been found to be a brown oil composed of isopilocarpine, pilocarpidine, pilocarpine, and coloring matter.

**Volatile Oil**.—Obtained by distillation at 176° C. (350° F.), and is chiefly a terpene (pilocarpene)  $C_{10}H_{16}$ , with a little solid paraffin-like substance, sp. gr. 0.875.

**Assay**: Exhaust drug 10 Gm. with chloroform containing 2 p. c. ammonia water, shake out tincture (100 Cc.) with normal sulphuric acid V. S. (15.2), transfer this latter solution to a second separator, make alkaline with ammonia water, shake out with chloroform 20, 15, 10, evaporate chloroformic solutions to dryness, dissolve alkaloidal residue in  $\frac{N}{10}$  sulphuric acid V. S. (7 Cc.), titrate excess of acid with  $\frac{N}{10}$  potassium hydroxide V. S., using cochineal T. S. or iodeosin T. S. indicator; divide Cc. of  $\frac{N}{10}$  potassium hydroxide V. S. by 5, subtract quotient from 7, multiply remainder by 0.02, and product by 10 = p. c. alkaloids present, or from amount of  $\frac{N}{10}$  sulphuric acid V. S. found to have been neutralized by the alkaloidal principles the p. c. present is calculated—each Cc.  $\frac{N}{10}$  sulphuric acid V. S. corresponds to 0.02 Gm. of alkaloids.

**PREPARATIONS**.—1 *Fluidextractum Pilocarpi*. Fluidextract of Pilocarpus. (Syn., Extractum Pilocarpi Fluidum, U. S. P. 1890; Fr. Extrait liquide de Jaborandi; Ger. Flüssiges Jaborandiextrakt.)

**Manufacture**: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.4 Gm. of alkaloids. **Assay**: Evaporate 10 Gm., with a little sand, to dryness, add 25 Cc. chloroform, + 2.5 ammonia water, shake, decant, wash sand with chloroform, shake out chloroform solution with normal sulphuric acid V. S., and proceed approximately as in assay of pilocarpus. Dose,  $\mathfrak{m}\text{xv}$ –30 (1–2 Cc.).



*Unoff. Preps.*: *Extract*, dose, gr. 3–10 (.2–.6 Gm.). *Infusion*, dose, ʒj–2 (30–60 Cc.). *Tinctura Jaborandi* (Br.), 20 p. c., dose, ʒss–2 (2–8 Cc.). Pilocarpine nitrate (Br.), phosphate, acetate, hydrobromide, dose, each gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.) (hypodermically).

**PROPERTIES.**—Diaphoretic, sialagogue, myotic, cardiac depressant, emetic, diuretic (repeated small doses), galactagogue, abortive. Full doses cause flushed face, quickened circulation and respiration, profuse sweating and salivation (lasting 2–4 hours, losing in perspiration 9–15 ounces (.27–.45 L.), in saliva 10–27 ounces (.3–.8 L.), these always being in the inverse ratio); increases bronchial, nasal, mammary, gastric, and intestinal secretions, lowers temperature 1–4 degrees, contracts pupils, produces chilliness and weakness. The heart soon becomes slowed and arterial pressure lowered, by stimulating the terminations of the vagus, or by depressing the motor centres in the heart-muscle. Both the fluid and solids (especially urea) of the perspiration are increased by direct influence on the nerve-endings governing its secretion, while the cells of the salivary glands are stimulated directly.

**USES.**—Dropsies, pleurisy, uræmia, pulmonic oedema, catarrhal jaundice, mumps, rheumatism, coryza, cold, influenza, Bright's disease, meningitis, diabetes, agalactia, parotitis, asthma, hiccough, erysipelas, diphtheria; best antidote to atropine, hyoscyamine, daturine, agaricin, etc.; powerful stimulant to hair growth, locally and internally. In ophthalmia use pilocarpine, in amblyopia (from alcohol or tobacco), detached retina, chronic iritis, keratitis, glaucoma, atrophic choroiditis, instead of eserine as a myositic. To avoid nausea, may give in form of enema.

**Poisoning**: Have profuse sweating, dizziness, salivation, vomiting, purging, contracted pupils, pain in eyes. Empty the stomach and wash it out with tannin; give atropine hypodermically and morphine to control nausea and vomiting; cardiac stimulants if necessary.

**Incompatibles**: Atropine, morphine, tannin, caustic alkalies, ferric and metallic salts.

**Synergists**: Aconite, veratrum, gelsemium, sarsaparilla, spirit of nitrous ether, and drugs which paralyze the vasomotor system.

#### *Allied Plants*:

1. *Pilocarpus Selloanus*; 2. *P. grandiflorus*; 3. *P. pauciflorus*; 4. *P. heterophyllus*; 5. *P. spicatus*; 6. *P. trachylophus*. All produce leaves of similar medicinal value.

## BUCHU. BUCHU.

**Barosma**  
**betulina**, (Thunberg) Bartling et Wendland. } The dried leaves.

**Habitat.** S. Africa, Cape Colony (Cape of Good Hope, Cape Town); mountains.  
**Syn.** Bookoo, Buku, Bucku, Bucco; Br. Buchu Folia, Folia Bucco, Diosma or Barosma; Fr. Feuilles de Bucco (Booko, Buchu); Ger. Bucku or Buccoblätter.

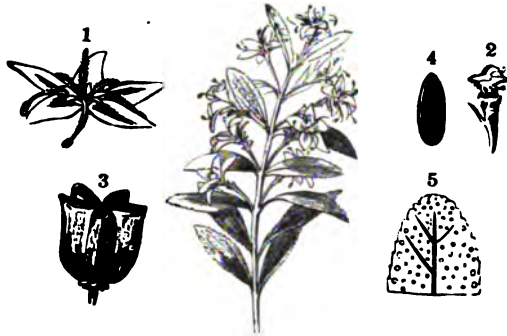
**Ba-ros'ma.** L. fr. Gr. βαρύς, heavy, + βούη, odor—i. e., its powerful smell.  
**Be-tu-li'na.** L. *betulinus*, fr. Celtic *betu*, their name for birch—i. e., leaves resembling birch leaves.

**Buchu** (bu'ku). African plant name; *Diosma*, old name, meaning "divine odor."

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**PLANT.**—Small bush .3–1.2 M. (1–4°) high, branches stiff, angular, bark smooth, purple; young twigs covered with immersed oil-glands; flowers solitary, pink; calyx 5 segments, deeply cut; petals 5, glandular-punctate; stamens 5; fruit, 5-cocci, adherent by inner margins,

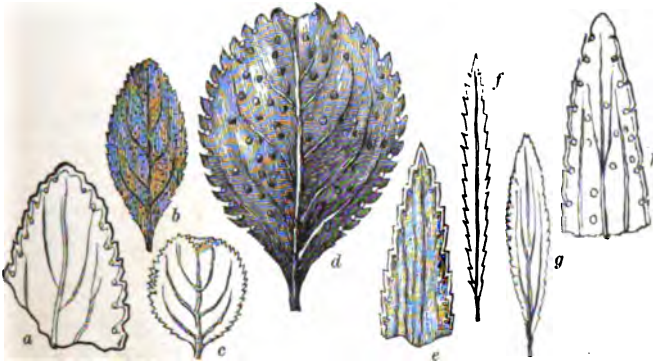
FIG. 218.



*Barosma crenulata*: 1, calyx; 2, style and stigma; 3, fruit; 4, seed; 5, dots on leaf.

9 Mm. ( $\frac{3}{8}$ ') long, 12 Mm. ( $\frac{1}{2}$ ') wide, 5-seeded. **LEAVES**, about 15 Mm. ( $\frac{3}{8}$ ') long, two-thirds as broad, oblong or obovate, abruptly contracted into a short petiole-like, cuneate base, crenate or serrate, with oil-gland at the base of each tooth, pellucid-punctate, yellowish-green,

FIG. 219.



Buchu: a, b, *Barosma crenulata*; c, d, *B. betulina*; g, h, *B. serratifolia*; e, f, *Empleurum serrulatum*; b, c, f, g, natural size.

coriaceous, both surfaces beset with numerous slight projections, odor strong, characteristic; taste somewhat mint-like, pungent, bitterish. **Solvents**: alcohol; boiling water partially. Dose, gr. 15–30 (1–2 Gm.).

**ADULTERATIONS.**—Leaves, branchlets, flowers, and non-aromatic capsules of allied species, also leaves of *Empleurum serrulatum*.

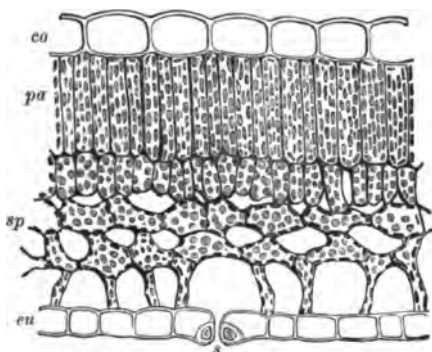
**Commercial.**—Have two market varieties: 1. *Short buchu*, which

comes from the official species, and also *B. crenulata*, whose leaves are somewhat similar, but 18–30 Mm. ( $\frac{3}{4}$ –1 $\frac{1}{2}$ ') long, 6–8 Mm. ( $\frac{1}{4}$ – $\frac{1}{2}$ ') broad; flowers white. 2. *Long buchu* (*B. serratifolia*), linear-lanceolate, 3–4 Cm. ( $1\frac{1}{5}$ –1 $\frac{3}{5}$ ') long, 6 Mm. ( $\frac{1}{4}$ ') wide, thinner, obtuse, tapers toward each end, mid-rib prominent, with 4 parallel veins; contains less of the active constituent (vol. oil 0.66 p. c.). Imported mostly in large bales.

**CONSTITUENTS.**—Volatile oil 1–1.6 p. c., bitter glucoside (barosmin), resin, gum, salt, ash 4–5 p. c.

**Volatile Oil**,  $C_{10}H_{16}O$ .—This gives the medicinal properties, and is obtained by distillation and rectifying over sodium; sp. gr. 0.969,

FIG. 220.



Buchu leaf: portion of a cross-section: *pa*, palisade cells; *sp*, spongy parenchyma; *co*, upper epidermis; *eu*, under epidermis; *s*, stomata.

FIG. 221.



*Ruta graveolens*.

contains some  $C_{10}H_{18}O$  (a body having peppermint-like odor), and upon cooling separates 30 p. c. barosma camphor, or phenol *diosphenol*,  $C_{10}H_{16}O_2$ , a stearopten occurring in white needle-like crystals, blackish-green with ferric salts.

**Barosmin** (*diosmin*, *rutin*).—Soluble in ether, volatile oils, dilute acids and alkalies, sparingly in alcohol, crystallizes in microscopic needles.

**PREPARATIONS.**—1. *Fluidextractum Buchu*. Fluidextract of Buchu. (Syn., *Extractum Buchu Fluidum*, U. S. P. 1890; Fr. *Extrait de Bucco*; Ger. *Flüssiges Buccoextrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\text{xv}$ –30 (1–2 Cc.).

**Unoff. Preps.:** *Tinctura Buchu* (Br.), 20 p. c. (alcohol 60 p. c.), dose,  $\mathfrak{z}\text{j}$ –2 (4–8 Cc.). *Infusum Buchu* (Br.), 5 p. c., dose,  $\mathfrak{z}\text{ss}$ –2 (15–60 Cc.).

**PROPERTIES.**—Diuretic, tonic, stimulant, carminative, diaphoretic; increases the fluids and solids of the urine, imparting peculiar odor;

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acts as a tonic, astringent, and disinfectant to the urinary tract, diminishing secretions. Large doses emetic, cathartic, causing burning in stomach, strangury; eliminated by the kidneys and bronchial mucous membrane.

USES.—Gravel, lithemia, vesical catarrh, irritated urethra, gonorrhea, gleet, chronic bronchitis, inflamed prostate, dropsy, retention or incontinence of urine, feeble digestion, flatulency; should not be given when inflammation is severe; often combined with alkalies, potassium hydroxide, etc. The native Hottentots, from whom the English and Dutch physicians learned its virtues, use an ointment as vulnerary and a vinous tincture in gastric and vesical affections; they also value it as a perfume, rubbing the powdered leaves upon the greased bodies.

*Allied Plants:*

1. *Barosma crenula'ta*, official 1840–1900, and *B. serratifolia*, official 1880–1890. *B. Ecklonia'na*.—Leaves oval, 2.5 Cm. (1') long, rounded at base, crenate, growing from pubescent shoots.

2. *Empleu'rum serrula'tum*.—Leaves sometimes mixed with buchu, occasionally constituting the main bulk; may be distinguished by their acrid taste, peculiar odor—differing from buchu—longer, narrower than even *B. serratifolia*, sides parallel, apex acute and glandless, coarsely dentate (serrulate); when held up to the light lateral veins not as straight, shorter and less strongly developed; contain peculiar volatile oil 0.64 p. c., possessing characteristic odor. Properties considered to differ from those of buchu.

3. *Ru'ta grave'olens*.—The leaves, official 1830–1880; S. Europe, cultivated. Plant .6–1 M. (2–3°) high, woody; flowers yellow; fruit capsule, 4–5-lobed; seeds black, many, all parts active; leaflets 12–25 Mm. (½–1') long, 6 Mm. (¼') wide, crenate, thick, pellucid-punctate, aromatic, bitter; contains volatile oil (Oleum Rutæ, official 1870–1890, greenish-yellow, aromatic), rutin, (rutic or rutinic acid,  $C_{12}H_{20}O_{25}$ —bitter, yellow, crystalline glucoside, identical with barosmin, decomposing into quercetin, etc.). Used as stimulant, emmenagogue, and nervine, in hysteria, colic, amenorrhœa. Dose, gr. 5–20 (.3–1.3 Gm.); oil, mj–5 (.06–.3 Cc.).

4. *Pte'lea trifolia'ta*, *Wafer-ash*, *Hop-tree*, *Swamp-Dogwood*, *Wing-seed*, *Shrubby Trefoil*. Root-bark; N. America—N. Y.—Fla.—Texas; rocky places. Handsome shrub, 2.4–3.6 M. (8–12°) high, branches dark brown; leaves petiolate, light green, trifoliate; leaflets sessile, ovate, short-acuminate, crenulate, lateral ones inequilateral, terminal one cuneate at base, finely pellucid-punctate; root-bark one or more inches long, light brown, wrinkled, with thin epidermis, internally yellowish-white, darker by exposure, odor peculiar, aromatic, taste bitter, pungent, acrid; contains berberine (bitter, tonic), tannin, gallic acid, resin. Aromatic, tonic, stimulant, antiperiodic; dyspepsia, low fevers with gastro-intestinal irritation, typhoid condition. Dose, gr. 15–30 (1–2 Gm.), infusion, ʒss–j (15–30 Cc.); fluidextract. Leaves and young shoots anthelmintic; fruit (samara) aromatic, bitter, good substitute for hops.

## RECAPITULATION No. 5.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Celastraceae</i> : 1. <i>Tamarindus</i> . 2. <i>Tamarind</i> .	<i>Tamarindus indica</i> .	The preserved pulp of the fruit.	India, Africa, (W. Indies).	Tartaric, malic, and acetic acids, potassium compounds, sugar, pectin, tannin.	Confection of senna.	Laxative, refrigerant.	Fevers, to correct nausea, quench thirst, sore.	Grains, 30-300 (2-20 Gm.).
<i>Hamamelidaceae</i> : 1. <i>Hamatoxylon</i> . 2. <i>Hamatoxylon</i> .	<i>Hamatoxylon campechianum</i> .	The heart-wood.	C. America.	Hamatoxylon, volatile oil, tannin, fat, resin.	Extract.	Astringent, tonic.	Diarrhoea, hemorrhages, dyspepsia, antiseptic, sores.	30-60 (2-4 Gm.).
1. <i>Copaiba</i> . 2. <i>Copaiba</i> .	One or more species.	The oleoresin.	Brazil.	Volatile oil, resin, bitter principle, copaibaic acid.	Oil.	Diuretic, stimulant, expectorant, laxative.	Urinary affections, cystitis, diarrhoea, bronchitis, hemorrhoids, dropsy, sores, fissures, gonorrhoea.	Minims, 10-60 (6-4 Cc.).
<i>Krameriaceae</i> : 1. <i>Krameria</i> . 2. <i>Krameria</i> .	<i>Krameria triandra</i> , <i>ixina</i> , <i>argentea</i> .	The dried root.	Peru, Bolivia, Colombia.	Krameric-tannic acid, rhamnic-red, starch.	Extract, trochee, fluidextract, syrup, tincture.	Astringent, tonic.	Diarrhoea, hemorrhage, gleet, fissures, sore throat, gums, eyes, nose.	Grains, 5-30 (3-2 Gm.).
<i>Popilionaceae</i> : 1. <i>Balsamum Peru</i> . 2. <i>Balsam of Peru</i> .	<i>Toluffera Pereira</i> .	The balsam.	C. America.	Cinnamene, resin, cinna-monic acid, benzoic acid.	.....	Stimulant, expectorant, vulnerary, stomachic.	Catarrhs, asthma, pathosis, gonorrhoea, rheumatism, ulcers, eczema, scabies.	Minims, 5-30 (3-2 Cc.).
1. <i>Balsamum Tolu</i> . 2. <i>Balsam of Tolu</i> . 1. <i>Tragacantha</i> . 2. <i>Tragacantha</i> .	<i>Toluffera Balsamum</i> . <i>Astragalus gummifer</i> .	The balsam. The gummy exudation.	S. America. W. Asia.	Resin, volatile oil, cinna-monic and benzoic acids. Bassorin, calcium compound of a gum-mucic acid, starch.	Syrup, tincture, tinct. benzoin comp. Mucilage.	Stimulant, expectorant, vulnerary.	Bronchitis, catarrhs, coughs, flavor, perflumery.	Grains, 5-30 (3-2 Gm.).
1. <i>Santalum Rubrum</i> . 2. <i>Red Saunders</i> . 2. <i>Kino</i> .	<i>Pterocarpus santalinus</i> . <i>Pterocarpus Mar-supium</i> .	The heart-wood. The inspissated juice.	S. Asia, Madras. E. Indies.	Resin, volatile oil, cinna-monic acid, pterocarpin, kinoid, pyrocatechin, kinoid.	.....	Demulcent, nutritious, expectorant.	Coughs, protective, expectant to pills and troches.	5-30 (3-2 Gm.).
1. <i>Glycyrrhiza</i> . 2. <i>Glycyrrhiza</i> . (Licorice Root).	<i>Glycyrrhiza glabra</i> , <i>ilifera</i> , <i>glandulifera</i> .	The dried rhizome and root.	S. Europe, W. Asia.	Glycyrrhizin, glycyrrhizin, asparagin, resin, starch.	Tincture. Extr., tro. g. et opli, tro. m. l., pure fluidextr., tro. g. co., gly. syr. sara. co., pulv. g. co. ellix. adjuv. fluidextr. sara. co. mass. hyd. pil. ferri tol., pulv. morph. co., tr. aloes, tr. aloes et myrrh.	Astringent, tonic. Demulcent, expectorant, laxative.	Diarrhoea, menorrhagia, leucorrhoea, ulcers, sore throat, catarrhs, bowel and urinary affections, coughs, colds.	5-20 (3-13 Gm.). 15-40 (1-4 Gm.).

<b>Cytisus scoparius.</b> 1. <i>Scoparium.</i> 2. <i>Scoparium.</i>	<b>Cytisus scoparius.</b> Flus.	The dried tops.	W. Asia, S. and W. Europe (Russia, Persia, Brazil).	Volatile oil, sperthine, scoparin, tannin, fat.	Spartine sulphate.	Diuretic, narcotic, emetic, euphoric.	Cardiac, dropsical, anesthetic, palpitation.	15-30 (1-2 Gm.).
<b>1. Chrysarobinum.</b> 2. <i>Chrysarobinum.</i>	<b>Vonacarpus Alarobis.</b>	The neutral principle.	W. Africa.	$C_{20}H_{32}O_2$ . Phytostigmine, caeridine, calabarine, starch, phytosterin, fat.	Ointment.	Irritant.	Parasitic, ringworm, hemorrhoids.	$\frac{1}{100}$ (0.008 Gm.).
<b>1. Phytostigma.</b> 2. <i>Phytostigma.</i>	<b>Phytostigma venenosum.</b>	The seed.	W. Africa.	Phytostigmine, caeridine, calabarine, starch, phytosterin, fat.	Extr. tinct., phytostigmine salicylate, phytostigmine sulphate.	Sedative, contractile, pupil, poisonous, emetic, purgative, diaphoretic.	Tetanus, paralysis, chorea, gastralgia, convulsions, strychnine- and atropine-poisoning.	1-4 (0.00-25 Gm.).
<b>Geraniaceae:</b> 1. <i>Geranium.</i> 2. <i>Geranium.</i>	<b>Geranium maculatum.</b>	The dried rhizome.	N. America.	Tannin, gallic acid, coloring, starch, sugar.	Fluidextract.	Astringent, tonic.	Diarrhea, hemorrhage, leucorrhoea, ulcers.	15-60 (1-4 Gm.).
<b>Linaceae:</b> 1. <i>Linum.</i> 2. <i>Linseed (Flax-seed).</i>	<b>Linum usitatissimum.</b>	The ripe seed.	Levant, S. Europe (United States).	Fixed oil, mucilage, proteins, amygdalin, resin.	.....	Demulcent, emollient, diuretic.	Internal inflammation, catarrh, dysentery.	60-120 (4-8 Gm.).
<b>1. Oleum Lin.</b> 2. <i>Linseed Oil.</i>	.....	The fixed oil.	.....	Linolein, glycerides of palmitin, myristin, and olein.	Soft soap, liniment of soft soap, linimentum calcis.	Demulcent, laxative.	Piles, erysipelas.	Minims. 240-960 (15-600 C.).
<b>Erythroxylaceae:</b> 1. <i>Coca.</i> 2. <i>Coca.</i>	<b>Erythroxylum: Coca, truxillense.</b>	The dried leaves.	S. America (Peru, Bolivia).	Cocaine, hygrine, benzoyl-eugonine, cinchonine, cocaine, truxilline, cocaine, coca-tannic acid.	Fluidextr., wine, cocaine, cocaine hydrochloride, oleatum.	Stimulant, tonic, diaphoretic, narcotic, anesthetic.	Wasting diseases, convalescence, stomatitis, bronchitis, surgery.	Grains. 15-60 (1-4 Gm.).
<b>Zygophyllaceae:</b> 1. <i>Gualiacum.</i> 2. <i>Gualiac.</i>	<b>Gualiacum: officinale, sanctum.</b>	The resin of the wood.	W. Indies, Northern S. America.	Gualiac acid, gualiac yellow, gualiac acid, gualiaconic acid.	Tincture, ammoniated tincture.	Stimulant, diaphoretic, alterative.	Syphilis, rheumatism, scrofula, skin affections.	5-30 (3-2 Gm.).
<b>Rutaceae:</b> 1. <i>Xanthoxylum.</i> 2. <i>Xanthoxylum.</i>	<b>Xanthoxylum americanum, Fagara (Java-Herculis).</b>	The dried bark.	N. America.	Volatile oil, resin, xanthoxylum-c, tannin.	Fluidextract.	Alterative, stimulant, emmenagogue, siagogogue.	Rheumatism, dropsy, syphilis, pharyngitis.	10-30 (6-2 Gm.).
<b>1. Pilocarpus.</b> 2. <i>Pilocarpus.</i>	<b>Pilocarpus: Jaborandi, microphyllus.</b>	The leaflets.	S. America (Brazil).	Volatile oil, pilocarpine, isopilocarpine, jaborine, salts, acid.	Fluidextract, pilocarpine hydrochloride.	Diaphoretic, stimulant, tonic.	Dropsy, rheumatism, pleurisy, coryza, Bright's disease, eye affections.	15-30 (1-2 Gm.).
<b>1. Buchu.</b> 2. <i>Buchu.</i>	<b>Barosma betulina.</b>	The dried leaves.	S. Africa.	Volatile oil, barosmin, diosphenol, resin, bitter principle (rutin).	Fluidextract.	Diuretic, stimulant, tonic.	Urinary troubles, bladder catarrh, etc., feeble digestion, flatulence.	15-30 (1-2 Gm.).

## AURANTII AMARI CORTEX. BITTER ORANGE PEEL.

*Citrus vulgaris*, *Risso*. } The dried rind of the unripe fruit.  
*(Citrus amara (Linné) Lyons.)*

*Habitat.* N. India, cultivated near the Mediterranean Sea, Spain, W. Indies, Madeira, China, S. and S. W. United States, Florida, California, etc.

*Syn.* Curaçao Orange, Aurantii Pericarpium, Cortex Pomorum Aurantii; Br. Aurantii Cortex Recens, Aurantii Cortex Siccatus; Fr. Ecorce (Zeste) d'Orange amère, Ecorce de Bigarade; Ger. Cortex Aurantii Fructus, Pomeranzenschale.

*Citrus*. L. fr. Gr. κίτριον, after the town of Citron in Judea, where it formerly flourished.

*A-ma'ra*. L. *amarus*, bitter—i. e., the decided bitter taste of the fruit.

*Vul-ga'ris*. L. ordinary, common—i. e., kind most universal.

*Au-ran'ti-um*. L. *aurum*, gold—i. e., yellow color of fruit.

*Orange*. Eng. fr. Skr. *nagarange* through the Arab. *naranj*.

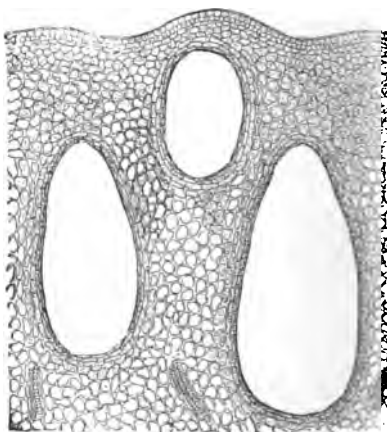
**PLANT.**—Small tree 3–4.6 M. (10–15°) high; stem branched; bark shining, smooth, greenish-brown; leaves 7.5–10 Cm. (3–4') long, ovate, evergreen, faintly serrate, with oil-vesicles, fragrant, petioles

FIG. 222.



*Citrus vulgaris (amara)*: 1, the end of a flowering twig; 2, flower, vertical section; 3, longitudinal section of ovary; 4, seed; 5, longitudinal section of seed; 6, diagram of flower.

FIG. 223.



Orange-peel: transverse section, magnified 65 diam.

12–25 Mm. ( $\frac{1}{2}$ –1') long; flowers May, 2.5 Cm. (1') broad, white; fruit 5–10 Cm. (2–4') in diameter, round, red or yellow, 9–11-celled, each several-seeded. **RIND** (zest), in narrow, thin bands or quarters, epidermis dark brownish-green, outer layer glandular with numerous oil reservoirs, inner layer spongy, thin, light yellowish-brown, odor fragrant, taste aromatic, bitter. *Solvents*: alcohol; water. *Dose*, gr. 15–30 (1–2 Gm.).

**SUBSTITUTIONS.**—Various parts of the tree are used in medicine;

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the leaves (bitter, aromatic) and dried flowers chiefly; both may be given in infusion as stimulant, diaphoretic; sometimes dried sweet orange-peel.

*Commercial.*—This bitter fruit mostly grows in Spain, Madeira, India, China, being known as Seville or Bigarade Orange. The Mandarin (*C. chinen'sis*), S. Europe, has pleasant taste, but is much smaller, also flattened at both ends, and has very thin rind. The celebrated Bizarria, of Italy, produces on the same stem, oranges, lemons, and citrons, and these often in mixed parts.

**CONSTITUENTS.**—Volatile oil, naringen (aurantiin) very bitter glucoside, aurantiamarin 1.5–2.5 p. c., leading bitter glucoside, isohesperidin 0.4–3 p. c., aurantiamaric acid 0.1 p. c., hesperidin, hesperic acid, (fixed oil, resin, gum, tannin, ash 4–5 p. c.).

**PREPARATIONS.**—I. **RIND**: 1. *Fluidextractum Aurantii Amari*. Fluidextract of Bitter Orange Peel. (Syn., Extractum Aurantii Amari Fluidum, U. S. P. 1890; Fr. Extrait liquide d'Écorce d'Orange amère; Ger. Flüssiges Pomeranzenschalenextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 65 p. c., q. s., evaporate to 100 Cc. Dose, ʒss–1 (2–4 Cc.).

2. *Tinctura Aurantii Amari*. Tincture of Bitter Orange Peel. (Syn., Br. Tinctura Aurantii; Fr. Teinture d'Écorce d'Oranges amères; Ger. Pomeranzen(schalen)tinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm., with alcohol 60 p. c., q. s. 100 Cc. Dose, ʒj–2 (4–8 Cc.).

3. *Tinctura Cinchonæ Composita*, 8 p. c. 4. *Tinctura Gentianæ Composita*, 4 p. c.

II. **FLOWERS**: 1. *Aqua Aurantii Florum Fortior*. Stronger Orange Flower Water. (Syn., Aqua Aurantii Florum, Triple Orange Flower Water.)

*Manufacture*: Obtained as a by-product in distilling oil of orange flowers, but may be made by collecting 3 parts of distillate from 2 of flowers. It is a saturated solution, neutral, strong odor of fresh orange flowers; should be colorless, clear, or faintly opalescent, not mucilaginous, and should give no reaction with hydrogen sulphide T. S. or ammonium sulphide T. S. (abs. of metallic impurities). Should be kept dark, in bottles loosely stoppered with a pledget of purified cotton. Dose, ʒj–4 (4–15 Cc.).

**Preps.**: 1. *Aqua Aurantii Florum*. Orange Flower Water. (Syn., Aqua Florum Naphæ; Fr. Eau (Hydrolat.) distillée de Fleurs d'Oranger, Eau de Naphe; Ger. Orangenblüthenwasser.)

*Manufacture*: By mixing equal volumes of stronger orange flower water and distilled water. Dose, ʒij–8 (8–30 Cc.).

**Preps.**: 1. *Syrupus Aurantii Florum*. Syrup of Orange Flowers. (Syn., Fr. Sirop de Fleurs d'Oranges; Ger. Pomeranzenblüthensirup.)

*Manufacture*: Dissolve sugar 85 Gm. in orange-flower water 45 Cc., adding the latter q. s. 100 Cc. Dose, *ad libitum*; as a flavoring vehicle.



2. *Syrupus Amygdalæ*, 10 p. c. 3. *Syrupus Calcii Lactophosphatis*, 5 p. c. 4. *Syrupus Lactucarii*, 5 p. c.

2. *Trochisci Acidi Tannici*, q. s. 3. *Trochisci Gambir*, q. s.

4. *Trochisci Krameriae*, q. s. 5. *Trochisci Santonini*, q. s.

*Unoff. Preps.*: *Infusum Aurantii* (Br.), 5 p. c., dose,  $\text{ziv}$ –8 (15–30 Cc.). *Infusum Aurantii Compositum* (Br.), 2.5 p. c. (+ lemon peel 1, cloves .6). *Vinum Aurantii* (Br.). *Oil of Flowers* (Nerol ).

**PROPERTIES.**—Stimulant, tonic, carminative, stomachic, bitter; excessive doses of both peel and oil cause colic, convulsions, occasionally death.

**USES.**—In indigestion, flatulence, corrigent to purgatives; aromatic when in combination with gentian, calumba, quassia, cinchona, etc.; most of the preparations are used as flavoring agents. Workmen employed among the fruit have skin eruptions, nervousness, headache, gastralgia, insomnia, muscular spasms.

#### AURANTII DULCIS CORTEX. SWEET ORANGE PEEL.

**Citrus**  
**Aurantium**, *Linn .* } The recently separated outer rind of the ripe fruit.

*Habitat.* Same as *C. vulgaris* (*amara*).

*Syn.* Cura ao, Navel (Seedless) Orange, Forbidden Fruit, Golden (Orange) Apple, Nerotia Flowers; *Fr.* Ecor e (*Zestes*) d'Oranges douces; *Ger.* Apfelsinenschalen.

**PLANT.**—Small tree 4.5–6 M. (15–20 ) high, identical with *C. vulgaris* (*amara*), differing only in point of variety. This has leaves and flowers more fragrant, also, fruit larger, sweeter, deeper yellow. **RIND**, similar to preceding, outer surface orange-yellow, with numerous oil reservoirs, odor highly fragrant, taste pungent, aromatic. *Solvents*: alcohol; water. Dose, gr. 15–30 (1–2 Gm.).

**Commercial.**—This sweet fruit grows only by cultivation; was unknown to the Greeks and Romans, being introduced first into Europe by the Portuguese in the fifteenth century. There are now some fifty varieties cultivated in Spain, Portugal, Madeira, Azores, China, West Indies, S. and S. W. United States, many of which have been given commercial names after the districts of production, as China, Portugal, Havana, Florida, California, Messina, and Malta (blood-red). These are imported in boxes of 100–200, having each orange wrapped in tissue-paper; the sweetest come to us from Havana, Florida, and California.

**CONSTITUENTS.**—Volatile oil, hesperidin, (fixed oil, resin, gum, tannin, ash 4–5 p. c.).

**Oleum Aurantii Corticis.** Oil of Orange Peel, *official.*—(*Syn.*, *Oleum Aurantiorum*, Essence (Essential Oil) of Orange; *Fr.* Huile d'Orange; *Ger.* Pomeranzenschalen l.) This volatile oil is produced mostly in S. Italy and Sicily, by expression from the fresh orange peel, or rupturing the oil-glands mechanically and collecting the liberated oil, as with oil of lemon; if obtained by distillation the product

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is decidedly less fragrant. It is a pale yellow liquid, characteristic, aromatic odor of orange, aromatic taste, sp. gr. 0.844, soluble in 4 volumes alcohol; contains limonene (citrene, hesperidene),  $C_{10}H_{16}$ , 90 p. c., odor bearers (citral, citronellal, methyl ester of anthranilic acid) 5 p. c. *Tests*: 1. Dextrogyrate at 25° C.; 77° F. (abs. oil of turpentine.) 2. When subjected to fractional distillation any oil coming over below 170° C. (338° F.) should not yield pinene nitrosochloride and nitrosopinene, nor have a terebinthinate odor or taste (abs. oil of turpentine). Formerly the oil from the bitter-orange peel was also official, but apart from its superior flavor the two are indistinguishable; it is

FIG. 224.



*Citrus Aurantium.*

produced in small quantity and usually is adulterated with the sweet orange oil. Should be kept cool, in small, well-stoppered, amber-colored bottles, to avoid development of terebinthinate odor, as such oil should not be dispensed; it is shipped in tinned-copper cans. Dose,  $\text{Mj-5}$  (.06–.3 Cc.).

**ADULTERATIONS.**—Oil of turpentine, alcohol, etc.

**PREPARATIONS.**—I. **RIND**: 1. *Tinctura Aurantii Dulcis*. Tincture of Sweet Orange Peel. (Syn., Fr. Teinture d'Orange douce; Ger. Apfelsinenschalentinktur.)

*Manufacture*: 50 p. c. Macerate 2 days, with frequent agitation, 50 Gm, with alcohol q. s. 100 Cc., filter. Dose,  $3j-2$  (4–8 Cc.); for flavoring.

*Preps.*: 1. *Syrupus Aurantii*. Syrup of Orange. (Syn., Syrup of Orange Peel; Fr. Sirop d'Écorce d'Orange; Ger. Pomeranzen(Orangen)-schalensirup.)

*Manufacture*: Triturate magnesium carbonate 1 Gm. with tincture of sweet orange peel 5 Cc., add gradually water 40 Cc., filter, in this dissolve citric acid .5 Gm., sugar 82, by agitation, add water q. s. 100 Cc. Dose, *ad libitum*; as a flavoring vehicle.

2. *Vinum Ferri*, 6 p. c. 3. *Vinum Ferri Amarum*, 6 p. c.

II. OIL: 1. *Spiritus Aurantii Composita*. Compound Spirit of Orange. (Syn., Fr. Esprit d'Orange composée; Ger. Zusammengesetzter Orangengeist.)

*Manufacture*: 20 p. c. Dissolve oil 20 Cc., + oil of lemon 5, oil of coriander 2, oil of anise .5, in alcohol, q. s. 100 Cc. As a flavoring vehicle.

Preps.: 1. *Elixir Aromaticum*. Aromatic Elixir. (Syn., Simple Elixir; Fr. Elixir aromatique; Ger. Aromatisches Elixir.)

*Manufacture*:  $1\frac{1}{2}$  p. c. To compound spirit of orange 1.2 Cc. add alcohol q. s. 25 Cc., to this add syrup 37.5, in several portions with agitation, add distilled water 37.5, purified talc 3 Gm., filter until clear, wash filter with 25 p. c. alcohol q. s. 100 Cc. As a flavoring vehicle.

Preps.: 1. *Elixir Adjuvans*, 88 p. c. 2. *Elixir Ferri, Quininae et Strychninae Phosphatum*, 85 p. c.

2. *Fluidextractum Rhamni Purshianae Aromaticum*, 1 p. c.

PROPERTIES AND USES.—Aromatic; mainly for flavoring and in perfumery; fruit edible.

## LIMON. LEMON.

1. LIMONIS CORTEX. Lemon Peel.

2. LIMONIS SUCCUS. Lemon Juice.

**Citrus**  
**Limon(1)um, Risso.** } 1. The recently separated outer rind of the ripe fruit. 2. The freshly expressed juice of the ripe fruit.

*Habitat*. N. India (cultivated in subtropics, Mediterranean Basin), United States (Cal., Fla.), Australia, etc.

*Syn.* Fr. Limon, Citron; Ger. Limone, Citrone. 1. Fr. Écorce (Zeste) de Citron (Limon); Ger. Cortex Fructus Citri, Flavido Corticis Citri, Citronen (Limonen)-schale. 2. Br. Succus Limonis, Succus Citro, Lemon (Lime)-juice; Fr. Suc de Citron (Limon); Ger. Citronen (Limonen) saft.

Li-mo'n(i)-um. L. for lemon. Arab, *limun* or *limu*, taken from Skr. *nimbuka*.

PLANT.—Straggling bush or tree, 3–4.5 M. (10–15°) high, more tender than the orange, having many angular branches and sharp spines in the leaf-axils; bark gray, that of branches green, of twigs reddish or purple; leaves evergreen, 5–6 Cm. (2–2 $\frac{1}{2}$ ') long, ovate, acute, serrate, 12 Mm. ( $\frac{1}{2}$ ') petioles; flowers all the year round, sweet-scented, white to purplish-pink; fruit ovoid berry 7.5 Cm. (3') long with nipple-shaped extremity, smooth, depressed punctations over the oil-glands, structure like orange; pulp acid, yellow; seeds as in orange, only smaller. PEEL, outer surface lemon-yellow, tissue beneath containing numerous large reservoirs; odor highly fragrant; taste pungently aromatic. The inner spongy portion should always be removed and not used. *Solvents*: alcohol; wine; water. Dose, 3ss–1 (2–4 Gm.). JUICE, slightly turbid, yellowish liquid, lemon odor due to accidental presence of rind's volatile oil; taste acid, often bitterish; sp. gr. 1.030,

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acidity due to 7 p. c. citric acid. *Assay*: To neutralize 10 Cc. should require 10 Cc. normal potassium hydroxide V. S., phenolphthalein T. S. indicator. *Impurities*: Sulphuric, acetic and tartaric acids, sulphates; ash about  $\frac{1}{2}$  p. c.; yield  $\frac{1}{2}$ –1 ounce (15–30 Cc.) per lemon. Dose, ʒij–5 (8–20 Cc.).

*Commercial*.—Lemons reach us from Florida, California, W. Indies, Mediterranean region, Sicily, Spain, packed in boxes, each lemon being wrapped in white or brownish tissue-paper. The foreign varieties are known as *wax*, *imperial*, *gæta*. When kept several months the citric acid decomposes into sugar and carbon dioxide; consequently to insure preservation they may be coated with melted paraffin, dissolved shellac, or varnish, thus permitting long shipments. The rind should be pared thinly from the fruit with sharp knives, then dried. The juice is obtained best by softening the fruit with the hands, dividing in halves, pressing with squeezers, and straining.

**CONSTITUENTS**.—I. **PEEL**; Volatile oil, hesperidin, ash 4 p. c.

**Oleum Limonis**. Oil of Lemon, *official*.—(Syn., Oleum de Cedro; Fr. Essence (Huile) de Citron—Cédrat; Ger. Citronenöl, Limonenöl.)

FIG. 225.



*Citrus Limon(i)um*: a, flower; b, fruit.

This volatile oil is produced mostly in Sicily, S. France and Italy (Calabria), by expression from fresh lemon peel, using several processes whereby the oil-cells are ruptured mechanically and thereafter the liberated oil collected: 1, *spugna*—collecting by sponge the oil from ruptured cells of the quartered rind; 2, *scorzetta*—of the halved rind; *machina*—substituting a complicated machine for manual labor of expression and collection; 4, *écuelle à piquer*—not much used, but

consisting of an instrument, bowl-shaped, 25 Cm. (10') wide, of tinned-copper, having a raised opening in the centre which forms with the outer edge a broad channel; to this there is a heavy cover similarly shaped, whose inner surface as well as that of the machine is armed with concentric rows of short 6 Mm. ( $\frac{1}{4}$ ') spikes or ridges; an opening in the bottom allows the escape of oil. By a handle the cover is made to revolve rapidly one-half minute over the instrument, having between the two 5 to 8 fruits, after which they are replaced by fresh ones. About 7,000 fruits can be exhausted daily by each machine. It is a pale yellow liquid, fragrant odor of lemon, aromatic, bitter taste, sp. gr. 0.855, dextrogyrate, soluble in 3 volumes alcohol; contains chiefly limonene (citrene),  $C_{10}H_{16}$ , 76 p. c., at least 4 p. c. (7-8) aldehyde, calculated as citral (this latter giving the aroma and value, being also produced by oxidizing geraniol,  $C_{10}H_{18}O$ , with chromic acid), little cymene,  $C_{10}H_{14}$ , citronellal,  $C_{10}H_{18}O$ , phellandrene, pinene, geranyl acetate, a sesquiterpene, octyl aldehyde, nonyl aldehyde, methyl heptenone, terpineol. *Assay*: For citral—5 Cc. oil + 5 distilled water — few drops phenolphthalein T. S., neutralize with sodium hydroxide V. S.; to 25 Cc. add 25 Cc. solution sodium sulphite (1 in 5), place in boiling water, add  $\frac{N}{2}$  hydrochloric acid V. S. to maintain neutrality, keep hot, agitate, add 1-2 drops phenolphthalein T. S.; when permanent neutrality reached, note number Cc.  $\frac{N}{2}$  hydrochloric acid V. S. consumed. Carry out blank test, omitting oil of lemon, note number Cc.  $\frac{N}{2}$  V. S. consumed; take difference in number Cc.  $\frac{N}{2}$  V. S., each Cc. corresponds to 0.03802 Gm. of citral, this quotient multiplied by 20 = p. c. of citral present. Should be kept cool, dark, in well-stoppered, amber-colored bottles.

**ADULTERATIONS.**—Oils of other *Citrus* fruits, fixed oils, alcohol, oil of turpentine. The fragrant *Oil of Petit Grain Citronnier*, from immature fruits, leaves, and twigs, closely resembles *Néroli Petit Grain*, and may be used similarly.

**Hesperidin**,  $C_{22}H_{36}O_{12}$ .—A glucoside (bitter principle) from the white, spongy part or rind by boiling water; bitter, yellowish-white powder or white needles; soluble in diluted alkalies or acetic acid, black with ferric salts, and by diluted sulphuric acid decomposed into hesperetin,  $C_{16}H_{24}O_6$ , and glucose,  $C_6H_{12}O_6$ .

**II. JUICE**: Citric acid 7-10 p. c., malic acid, gum, sugar 0.5-1 p. c., ash 0.5 p. c. (= K 45, Ca 8,  $H_3PO_4$  7-15 p. c.).

**Acidum Citricum.** Citric Acid,  $H_3C_6H_5O_7 + H_2O$ , *official*.—A 7 p. c. solution of this acid in water with  $\frac{1}{2}$  p. c. oil of lemon resembles closely lemon-juice in strength, may be substituted for it, and like it undergoes decomposition, becoming mouldy, forming acetic acid and other products.

**PREPARATIONS.**—**I. PEEL**: 1. *Tinctura Limonis Corticis*. Tincture of Lemon Peel. (Syn., Fr. Teinture d'Écorce de Citron; Ger. Citronenschalentinktur.)

*Manufacture*: 50 p. c. Macerate 2 days, frequently agitating, 50 Gm. with alcohol q. s. 100 Cc., filter. Dose, 3ss-2 (2-8 Cc.).

## SIMARUBACEÆ.

Preps.: 1. *Syrupus Acidi Citrici*, 1 p. c. 2. *Syrupus Hypophosphitum*,  $\frac{1}{2}$  p. c.

II. OIL: 1. *Spiritus Ammoniac Aromaticus*, 1 p. c. 2. *Spiritus Aurantii Compositus*, 5 p. c.

Unoff. Preps.: I. PEEL: *Spirit*, 5 p. c. + oil 5 p. c. (alcohol), dose, ʒss 2 (2–8 Cc.). *Syrup. Infusion*. II. JUICE: *Syrup*.

The juice is used mostly alone or neutralized by alkali; soon spoils, but will keep a short time by letting stand to coagulate albumin, straining into hot bottles, and covering top with almond or sweet oil; the flavor is preserved best by making concentrated syrup.

PROPERTIES AND USES.—I. PEEL: Stimulant, stomachic; added usually to infusions, tinctures, etc., chiefly for flavoring.

II. JUICE: Refrigerant, relieves thirst, febrile inflammatory affections in agreeable beverages. Diaphoretic (as neutral mixture), scurvy (seamen on long voyages should take ʒj (30 Cc.) daily as a preventive), acute rheumatism. Locally in sunburn, pruritus of scrotum, uterine hemorrhage after labor, gargle in diphtheria.

*Limones, Lemons.* The fruit, official 1830–1860.

*Allied Plants:*

1. *Citrus Bergamia*, *Bergamot*.—Volatile oil, official 1840–1900; S. Italy, France; cultivated. Small tree resembling the lemon and orange, flowers peculiar, delicious odor, fruit pale lemon color, pyriform or globose, with concave receptacles of oil in the rind. Oil obtained as that of lemon and orange, and is a greenish, thin liquid, peculiar fragrant odor, aromatic bitter taste; contains limonene (citrene), dipentene (bergamot camphor), linalool, and linalool acetate 36–39 p. c., upon which the value chiefly depends. Stimulant, excitant, aromatic; used exclusively as a perfume.

2. *C. medica*, *Citron*.—Small tree, but fruit very large, 20–22.5 Cm. (8–9') long, resembling pineapple in shape. The rind is popular as a dessert, essence in perfumery, and juice for similar purposes as that of lemon and lime fruits.

3. *Ægle*, *Mar'melos*, *Bela*, *Bael*, *Bengal Quince*.—Malabar, Coromandel, cultivated in India. Fruit round, size of a large orange, cherry-red color, aromatic, sweetish, acidulous, mucilaginous, astringent when unripe, laxative when ripe, seeds woolly, pulp firm, brittle, 12-celled, covered with hard, gourd-like nearly smooth rind. The dried, half-ripe fruit is used, which is adulterated sometimes with fruit of *Garcinia Mangostana*, *Mangosteen*; contains gum, pectin, sugar, tannin, bitter principle, volatile oil. It is mildly astringent. Dose, gr. 15–30 (1–2 Gm.), in diarrhœa, dysentery.

45. SIMARUBACEÆ. *Quassia* Family.

Sim-a-ru-ba'se-e. L. *Simarub-a* + acœe; from native name in Guiana. Shrubs, trees. Distinguished by containing bitter principle, and from allied Rutaceæ, by leaves being exstipulate, without glands or dots, alternate; ovary stalked, 4–5-lobed, superior; ovules 1 in

each cell; stamens 8–10, augmented each by 1 or more scales; calyx 4–5; petals 4–5; fruit drupe; seed exalbuminous; tropics; bitter, tonic, febrifuge.

Genera: 1. *Picrasma*. 2. *Quassia*.

## QUASSIA. QUASSIA.

*Picrasma excelsa*, (Swartz) Planchon, } The wood.  
*Quassia amara*, Linné.

*Habitat*. 1. W. Indies (Jamaica, St. Kitt's, Antigua, St. Vincent. 2. Surinam, W. Indies, Brazil, Guiana, Columbia, Panama.

*Syn*. Bitter Ash—Bark—*Quassia* or Wood, Lofty *Quassia*, Bitterwood Tree; Br. *Quassia*, Lignum; Fr. Bois (amer) de *Quassia*; Ger. Lignum *Quassia*, Quassienholz.

*Pic-ras'ma*. L. fr. Gr. *πικρός*, bitter—i. e., the plant's chief property.

*Quas'si-a*. L. fr. *Quassi*, *Quassy*, *Quash*, name of Surinam negro slave who used bark as a secret remedy in curing malignant fevers (febrifuge).

*Ex-cel'sa*. L. *excelsus*; ex, out, + *celsus*, beyond, surpassing—i. e., highest species of the genus.

*A-ma'ra*. L. *amarus*, bitter—i. e., the intense bitterness of the wood.

PLANTS.—1. *Picrasma excelsa*. Tree 15–24 M. (50–80°) high, .6–1 M. (2–3°) thick, erect, spreading, resembles our common ash; bark brownish-gray, smooth, wrinkled; leaves imparipinnate, 4–5 pairs; leaflets 5–10 Cm. (2–4') long, ovate, petiolate, when young covered with fulvous down; flowers Oct.–Nov., small, yellowish-green, panicles, polygamous; fruit Dec.–Jan., black drupe, size of pea. 2. *Quassia amara*. Small branching tree or shrub; flowers bright red, rather large, racemes, hermaphrodite, decandrous; fruit 2-celled capsule, seed globular. WOOD (*P. excelsa*), in various forms, usually chips, raspings, or billets, yellowish-white, coarse texture; medullary rays containing tetragonal prisms or small arrow-shaped crystals of calcium oxalate; billets 12.5 Cm. (5') or more thick, medullary rays in tangential section 3–5 rows of cells wide; (*Q. amara*), in billets about 7.5 Cm. (3') thick, wood heavier, harder, more deeply colored than preceding, medullary rays in tangential section 1–2 rows of cells wide; odor slight; taste intensely bitter. *Solvents*: water; diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

*Commercial*.—There are two commercial varieties: 1. *Jamaica Quassia* (*Picrasma excelsa*). This tree, also named *Quassia excelsa*, *Simaruba excelsa*, is felled, cut into segments, and shipped from Jamaica with or without the bark; the wood at first is white, but turns yellow by age; upon reaching this country it is turned into quassia cups, etc., the shavings being reserved for store use. 2. *Surinam Quassia* (*Quassia amara*). This was the original quassia upon which its reputation was established; the slave Quassi became celebrated for treating fevers with it, and was prevailed upon to reveal his secret for compensation, in 1756, when the drug was taken to Stockholm, soon to become popular in Europe and elsewhere; owing to scarcity and smallness of the plant, the supply failed to meet the demand, consequently the necessity for recognizing also the more abundant and larger tree.

## SIMARUBACEÆ.

**CONSTITUENTS.**—Picrosmin (quassiin) 0.05–0.15–0.75 p. c., alkaloid (yellowish, blue fluorescence with acidified alcohol), resin, mucilage, pectin; Surinam quassia also contains trace of tannin, giving black or bluish-black with ferric salts.

**Picrosmin.**—Obtained by neutralizing infusion with sodium hydroxide, precipitating with tannin, decomposing precipitate by heating with lead oxide or lime, dissolving out with alcohol. It is a mixture of two crystalline compounds, *α*-picrosmin,  $C_{35}H_{46}O_{10}$  and *β*-picrosmin,  $C_{36}H_{48}O_{10}$  homologous with quassiin,  $C_{32}H_{40}O_{10}$ , of Surinam quassia, crystallizing in needles or prisms, soluble in alcohol, chloroform, 1,200 parts water. Dose (amorphous) gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.); (crystalline) gr.  $\frac{1}{32}$ – $\frac{1}{8}$  (.002–.02 Gm.).

FIG. 226.

*Picrasma excelsa.*

**PREPARATIONS.**—1. *Extractum Quassie.* Extract of Quassia. (Syn., Fr. Extrait de Quassie (Bois amer); Ger. Quassiaextrakt.)

**Manufacture:** Percolate 100 Gm. with water until exhausted, evaporate to three-fourths of its bulk, strain, evaporate to dryness, add sugar of milk q. s. 100 Gm., mix thoroughly, reduce to fine powder. Should be kept in well-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).



2. *Fluidextractum Quassiae*. Fluidextract of Quassia. (Syn., Extractum Quassiae Fluidum, U. S. P. 1890; Fr. Extrait liquide de Quassie; Ger. Flüssiges Quassiaextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 33 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv–30 (1–2 Cc.).

3. *Tinctura Quassiae*. Tincture of Quassia. (Syn., Fr. Teinture de Quassie (amère); Ger. Quassiatinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol 35 p. c., q. s. 100 Cc. Dose, ℥xv–60 (1–4 Cc.).

*Unoff. Preps.*: *Infusum Quassiae* (Br.), 10 p. c., dose, ℥iv–8 (15–30 Cc.). *Liquor Quassiae Concentratus* (Br.), 10 p. c. *Syrup*, for fly poison.

**PROPERTIES.**—Tonic, febrifuge, anthelmintic, simple bitter (similar to calumba).

**USES.**—Atonic dyspepsia, diarrhoea, gastric vertigo, constipation, loss of appetite, poisons flies (*papier mouri*), fish, dogs, rabbits. Infusion (℥viii; 240 Cc.), patient being in the knee-chest position, as enema for thread worms (*Oxyuris vermicularis*) or ascarides of rectum, internally for lumbricoid worms. Large doses cause headache, nausea, vertigo, vomiting, diarrhoea, cramps, narcosis. Substituted for hops in making beer and ale.

*Allied Plants*:

1. *Simaruba amara* (*S. officinalis*, *S. medica*, *Quassia Simaruba*).—The bark (of root), official 1820–1880; Guiana to N. Brazil, W. Indies. Tree 15–18 M. (50–60°) high, crooked branches; leaves 22.5–30 Cm. (9–12') long, leaflets 3–5 pairs, 5–10 Cm. (2–4') long; flowers yellow; fruit drupes; bark flat, curved, or quilled, .5–1 M. (20–40') long, 3 Mm. (⅛') thick, yellowish-brown, striate, fibrous, bitter; con-

FIG. 227.



Jamaica quassia wood: cross-section magnified 3 diam.

FIG. 228.



*Simaruba amara* (*officinalis*): 1, calyx and ovary; 2, corolla; 3, stamens; 4, stamen and anther.

tains picrosamin, resin, volatile oil, calcium oxalate. Used as tonic, febrifuge, diuretic (large doses cause vomiting and purging), for

**BURSERACEÆ.**

dysentery, diarrhœa (*dysentery bark*), etc.; in infusion, decoction. Dose, gr. 10–30 (.6–2 Gm.).

2. *Sima'ba ce'dron* and *S. ferrugin'ea*.—Colombia, Brazil; resembles simaruba, but flowers hermaphrodite; fruit pear-shape, size of hen's egg. Used natively as febrifuge and as antidote to poisonous animal bites.

3. *Me'lia Azed'arach*, *Margosa Bark*, *Pride of India*.—Meliaceæ. The bark of the root, official 1820–1890, China, India, cultivated, S. United States. Beautiful tree 9–12 M. (30–40°) high, leaves imparipinnate; flowers lilac color; fruit drupe, yellow, size of cherries, poisonous pulp; never leafless. Bark curved or quilled, 5–7.5 Cm. (2–3') long, 5 Mm. ( $\frac{1}{5}$ ') thick; outer surface reddish with irregular blackish ridges; inner surface whitish or brownish, striate, sweet, bitter, nauseous; contains resin, tannin, sugar. Used for lumbricoid worms, emetic. Dose, gr. 15–60 (1–4 Gm.), in decoction, tincture (diluted alcohol).

4. *Sycocar'pus Rus'byi*, *Cocillana*.—Meliaceæ. Bolivia. Bark thick, ash-colored, rough by age, inner surface grayish-yellow, odor slight, peculiar, taste unpleasant, nauseous; contains rusbyine, two alkaloids, tannin, calcium oxalate. Expectorant (better than ipecac), laxative, emetic; bronchitis, bronchial pneumonia, phthisis. Dose, gr. 5–20 (.3–1.3 Gm.).

**46. BURSERACEÆ (AMYRIDACEÆ). Myrrh**  
(Frankincense) Family.

Ber-se-ra'se-e. L. *Burser-a* + aceæ, after Joachim Burser, German botanist, at Naples, seventeenth century. Trees or shrubs. Distinguished by secreting fragrant gumresinous or resinous juice; leaves compound, dotted; ovary sessile, 1–5-celled, ovules in pairs; flowers perfect; calyx 2–5 divisions; petals 3–5; stamens twice the petals; fruit dry, 1–5-celled; seed exalbuminous, superior; tropics; bitter, purgative, anthelmintic, poisonous; lumber.

Genus: 1. **Commiphora**.

MYRRHA. MYRRH.

**Commiphora**  
**Myrrha**, (*Nees*) Engler. } A gumresin.

*Habitat.* E. Africa, S. W. Arabia, Somali country, around Hurrur.

*Syn.* Somali (Herabol) Myrrh, Resina Balsemodendri, Gummi-resin Myrrha; Fr. Myrrhe; Ger. Myrrha, Myrrhe.

**Com-miph'o-ra.** L. fr. Gr. κόμμη, gum, + φέρω, φέρειν, bears, to bear—i. e., produces gummy exudation.

**My'r'ra.** L. fr. Gr. μύρρα, classic name = Ar. murr; Heb. mar, bitter—i. e., gumresin has bitterish taste.

**PLANT.**—Low, stunted bush or small tree 2.5–3 M. (8–10°) high; trunk considerable size, with many irregular, knotty, abortive branches at right angles, terminating in sharp spines; bark whitish-gray; leaves trifoliate, 2.5 Cm. (1') long, petiolate; leaflets sessile, 12 Mm. ( $\frac{1}{2}$ ') long, unequal, obovate, central one the largest; flowers diœcious; fruit 12 Mm. ( $\frac{1}{2}$ ') long, pyriform. **GUMRESIN** (myrrh), in roundish, irregular tears or masses, dusty, brownish, reddish; fracture waxy,

splintery, translucent on edges, sometimes with whitish veins; odor balsamic; taste aromatic, bitter, acrid; triturated with water gives brownish-yellow emulsion; with alcohol brownish-yellow tincture, turning purplish-red with nitric acid; does not swell or dissolve in water. If dark-colored tears used, get no purplish-red with nitric acid, hence such pieces and others which dissolve completely or simply swell in water should be rejected. *Solvent*: alcohol, in which not more than 70 p. c. should be insoluble. Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—Gumresin of allied species (fracture more transparent or opaque, odor and taste different), vegetable fragments, sand, salt, dark gums swelling or adhesive with water.

**Commercial.**—Trees form an undergrowth in the Red Sea coast forests, where vegetation is scanty, water scarce, temperature high, the favored elevation being 450–900 M. (1,500–3,000°). Myrrh is formed in the bark and pith, and exudes spontaneously as a juice through the stem-bark like cherry-tree gum; at first soft, oily, yellowish, then golden, finally hard and reddish. Mostly collected by the Somalis, both at home and across Aden Gulf in Arabia. Formerly entered commerce via Egypt and Levant ports, hence name *Turkey myrrh*; now conveyed to the great fair of Berbera, where it is purchased by Banians of India, thence shipped via Aden to Bombay; here it is assorted into grades (bdellium separated) and put into chests of 100–200 pounds (45–90 Kg.) for market.

There are several varieties, all from the same genus:

1. *Turkey, African*, the best and is our official kind.
2. *Arabian*, cultivated in S. Arabia, east of Aden, called by Arabs *mur*, by Somalis *mulmul* or *heerabul*; resembles Turkey myrrh, but is more brittle, has no white lines in the fracture, and only 25 p. c. is soluble in alcohol.
3. *Indian, Myrrha Indica*, called natively *bissabul*, by Somalis *hebbakhade*; resembles dark myrrh, but differs in odor, resembling that of mushrooms; taste strong, almost acrid; has many impurities.

**CONSTITUENTS.**—Volatile oil 4–8 p. c., Resin 25–40 p. c., Gum 40–60 p. c., bitter principle (glucoside, soluble in alcohol, water), ash 3–4 p. c. = mostly calcium carbonate.

**Volatile Oil**,  $C_{10}H_{14}O$ .—Also called *myrrhol* or *myrrhenol*. Identical in formula with thymol and carvol, but distinct from them; easily resinifies, pale yellow, thick liquid, sp. gr. 0.980

**Resin**,  $C_{48}H_{32}O_{10}$ .—Often called *myrrhin*, becomes acid (*myrrhic acid*) when kept fused a short time, soluble in alcohol, chloroform, ether; with fusing potassium hydroxide yields *protocatechuic acid* and *pyrocatechin*.

FIG. 229.



*Commiphora Myrrha*: 1, fruit-bearing twig; 2, ripe fruit; 3 and 4, vertical section of pistillate and staminate flowers respectively; 5, embryo.

**BURSERACEÆ.**

**Gum.**—Two kinds, four-fifths being soluble in water, adhesive, making stable paste; one precipitated by neutral, the other by basic, lead acetate.

**PREPARATIONS.**—1. *Tinctura Myrrhæ*. Tincture of Myrrh. (Syn., Fr. Teinture de Myrrhe; Ger. Myrrhentinktur.)

*Manufacture*: 20 p. c. Macerate 3 days 20 Gm. with alcohol q. s. 100 Cc., filter. Dose, ℥xv–60 (1–4 Cc.); mostly used externally.

2. *Tinctura Aloes et Myrrhæ*, 10 p. c. 3. *Pilulæ Aloes et Myrrhæ*, 1 gr. (.06 Gm.). 4. *Pilulæ Rhei Compositæ*, 1 gr. (.06 Gm.). 5. *Mistura Ferri Composita*, 1.8 p. c.

*Unoff. Preps.*: *Fluidextract*, dose, ℥v–30 (.3–2 Cc.). *Plaster*.

**PROPERTIES.**—Stimulant, tonic, expectorant, emmenagogue, astringent, carminative, vulnerary. Increases circulation and the number of white blood-corpuscles; it is eliminated by the genito-urinary and bronchial mucous membranes, augmenting and disinfecting their secretions; large doses vomit, purge, decrease bronchial secretion. Locally, stimulant, disinfectant, and antiseptic to mucous membranes, ulcerated surfaces, etc.

**USES.**—Atonic dyspepsia, amenorrhœa, anæmia, bronchial catarrh, cystitis, pharyngitis, chronic uterine and vaginal leucorrhœa. Locally—ulcerated spongy gums, diseased mucous surfaces, relaxed throat, ptialism, ozæna, indolent ulcers. Tincture freely diluted with water a good disinfectant gargle to ulcerated sore throat; much used in tooth powders and wash.

*Allied Plants*:

1. *Commiphora* (*Balsamoden'dron*) *Opobal'samum*, *Bal'samum Gileaden'se*, *Balm of Gilead*, *Mecca Gum*, *Indian Bdellium*.—Greenish turbid oleoresin, rosemary odor. *C. Mu'kul* and *C. africa'na*, *Indian and African Bdellium*. Occurs in tears, yellowish-brown, dusty, translucent; resembles myrrh, but does not give purplish-red with nitric acid; both contain volatile oil, resin, gum, and the latter a bitter principle.

2. *Boswell'ia Curte'rii*, *Olibanum*, *Frankincense*.—E. Africa, S. Arabia. This gumresin exudes from incisions made in the bark; occurs in yellowish-brown tears covered with white dust; odor balsamic, terebinthinate; taste balsamic, bitter; partly soluble in alcohol; yields with water milk-white emulsion; contains volatile oil 4–7 p. c. (mostly *olibene*,  $C_{10}H_{16}$ ), resin 56–72 p. c., gum (resembles arabin), 30 p. c., bitter principle, ash 3. p. c. Stimulant, expectorant. Dose, gr. 15–30 (1–2 Gm.), in emulsion, plaster, or fumigation.

3. *Cana'rium commu'ne*, *Manila Elemi*, *Elemi*.—Philippine Islands. The oleoresin exudes from incisions in the bark of a tall tree; it is soft, yellowish, granular crystalline, when cold friable; odor strong, resembling fennel and lemon, terebinthinate; taste bitter, pungent; contains volatile oil 10–15 p. c., amorphous resin (*brein*) 60 p. c. (soluble in cold alcohol), crystalline resin (*amyrin*) 25 p. c., bryoidin, breïdin, elemic acid,  $C_{33}H_{46}O_4$  (crystalline). Stimulant, irritant; in plaster and ointment.

## 47. POLYGALACEÆ. Milkwort Family.

Pol-i-ga-la'se-e. L. *Polygal-a* + aceæ, fr. Gr. πολύς, much, + γάλα, milk—i. e., believed to increase lacteal secretion in female animals. Shrubs and herbs. Distinguished by bitter, acrid properties and milky roots; flowers papilionaceous; petals 3–5, more or less united; sepals 5, of which 2 anterior are lateral, larger; petaloid, forming the wings to the flowers; stamens 8, monadelphous; ovary 2–3-celled; anthers open at apex; fruit capsular; universal; bitter, acrid, tonic, stimulant; febrifuge, astringent, emetic, purgative, diuretic, sudorific, expectorant; fruit edible, saponaceous.

Genus: 1. *Polygala*.

## SENEGA. SENEGA.

*Polygala*  
*Senega*, Linné. } The dried root.

FIG. 230.

*Polygala Senega*.

*Habitat.* United States, in woods and rocky soil; Can. to S. Ca., west to Wis.

*Syn.* Senega Snake Root, Seneca, Seneka, or Snake Root, Rattlesnake Root, Milkwort, Mountain Flax; Br. *Senegæ Radix*; Fr. *Polygala de Virginie*; Ger. *Senegawurzel*.

*Po-lyg'a-la.* L., see etymology, above, of Polygalaceæ.

*Sen'e-ga.* L. fr. the Seneca (Senega) tribe, one of the five N. American Indian tribes; they inhabited W. New York and used this plant as a remedy for snake-bites.

FIG. 231.

*Polygala Senega*: root, natural size; b, b, the keel.

PLANT.—Perennial herb; stems several, erect, 22.5–37.5 Cm.

**POLYGALACEÆ.**

(9–15') high, smooth, round, leafy, occasionally reddish or purplish below, green above; leaves 2.5–5 Cm. (1–2') long, 12 Mm. ( $\frac{1}{2}$ ') wide, lanceolate, sessile, margins rough, bright green; flowers May–June, small, diadelphous, white, spike 2.5–5 Cm. (1–2') long, calyx showy; sepals 5 (3 small, green; 2 larger, petaloid, called wings); corolla small, closed; fruit capsule, 2-celled, compressed, 2-seeded, black. Root, somewhat cylindrical, tapering, more or less flexuous, 3–15 Cm. ( $1\frac{1}{5}$ –6') long, 2–8 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ') thick, bearing several similar horizontal branches and a few rootlets, crown knotty with numerous buds and short stem-remnants, yellowish-gray or brownish-yellow, longitudinally wrinkled, usually marked by a keel which is more prominent in perfectly dry roots near the crown, fracture short, wood light yellow, usually eccentrically developed; odor slight, nauseating; taste sweetish, acrid. *Solvents*: boiling water; alcohol; diluted alcohol. Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—*Gillenia*, *cypripedium*, and *tristeam* (rhizome + roots), American gentians (rootlets) often to 25 p. c.—resulting from careless collection and intentional fraud. In Europe the underground portion of *Cynan'chum Vincetox'icum* is used also; none of these has a keel, some contain starch, and all differ in odor and taste.

**Commercial.**—The official root, as well as some of the growing plants of this genus emit a slight wintergreen odor; the southern root is smaller and usually paler, while the Manitoba is larger and stouter, often dark, colored with purple discoloration about the crown; the large, broad-leaved form is considered var. *latifolia*. Root should be collected in the autumn, and comes chiefly from Minnesota and northward.

**CONSTITUENTS.**—Saponin-like compound 5–6 p. c., composed of senegin 1.5 p. c., and polygalic acid 4 p. c. (analogous to saponin and components, quillajic acid, quillaja-sapotoxin, of quillaja), fixed oil 8–9 p. c., volatile oil 0.12 p. c., methyl salicylate (increasing with age), resin, polygalite, sugar 7 p. c., pectin and albuminoids 18.40 p. c., malates, yellow coloring matter, ash 5–7 p. c.

**Senegin** (*polygalin*, *saponin*),  $C_{32}H_{54}O_{18}$ .—Obtained by exhausting root with 60 p. c. alcohol, concentrating, precipitating with alcohol and ether; mother-liquor contains the salt of an organic acid. It is a neutral glucoside, white, amorphous, inodorous powder, insoluble in alcohol, not precipitated by normal lead acetate, and forms soapy emulsion with boiling water; by hydrochloric acid decomposed into glucose and sapogenin,  $C_{14}H_{22}O_2$ .

**Polygalic Acid.**—Sparingly soluble in alcohol, insoluble in ether or chloroform, precipitated by neutral and basic lead acetates.

**Fixed Oil.**—Obtained from root by ether; contains virgineic acid which gives disagreeable aroma.

FIG. 232.



Senega: transverse sections magnified.

**Volatile Oil.**—This is a mixture of valerianic ether and methyl salicylate.

**PREPARATIONS.**—1. *Fluidextractum Senegæ*. Fluidextract of Senega. (Syn., *Extractum Senegæ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Polygale de Virginie*; Ger. *Flüssiges Senegaextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 60 Cc., water 30, solution of potassium hydroxide 3, finishing with alcohol 65 p. c., q. s., evaporate to 100 Cc. Dose,  $\mathfrak{M}\nu$ –30 (.3–2 Cc.).

*Preps.*: 1. *Syrupus Senegæ*. Syrup of Senega. (Syn., Fr. *Sirap de Polygale*; Ger. *Senegasirup*.)

*Manufacture*: Mix fluidextract of senega 20 Cc. with syrup 80 Cc. Dose,  $\mathfrak{zj}$ –2 (4–8 Cc.).

2. *Syrupus Scillæ Compositus*, 8 p. c.

*Unoff. Preps.*: *Abstract*, dose, gr. 5–10 (.3–.6 Gm.). *Infusum Senegæ* (Br.), 5 p. c., dose,  $\mathfrak{z}\text{iv}$ –16 (15–60 Cc.). *Liquor Senegæ Concentratus* (Br.), 50 p. c., dose,  $\mathfrak{zss}$ – $\mathfrak{j}$  (2–4 Cc.). *Tinctura Senegæ* (Br.), 20 p. c., dose,  $\mathfrak{zss}$ – $\mathfrak{j}$  (2–4 Cc.).

**PROPERTIES.**—Stimulating expectorant, diuretic, diaphoretic, irritant. Produces throat and gastro-intestinal irritation, some salivation with inclination to cough, increased bronchial secretion; large doses vomit and purge. Insufflation causes sneezing, coughing, and nasal catarrh. Externally—an irritant to the skin.

Senegin is a violent irritant, heart depressant, likewise same to vascular, nervous, and muscular systems. It is excreted by kidneys, skin, bronchial mucous membrane, all being stimulated and irritated by it.

**USES.**—Secondary stage of acute and in chronic bronchitis, in typhoid pneumonia, asthma, croup, renal dropsy, promotes expectoration; no value when mucus tough and scanty, or unless the primary acute inflammation has been subdued. In amenorrhœa, give decoction two weeks before each menstruation, chronic rheumatism, rheumatic paralysis; senegin is given in 2 gr. (.13 Gm.) doses for uterine hemorrhage. Popular with North American Indians for rattlesnake and other snake-bites.

#### *Allied Plants:*

1. *Polygala al'ba*, *White, Texas* or *False Senega*.—West of Mississippi River; root 6 Mm. ( $\frac{1}{4}$ ') thick, resembling official, but has a lighter color internally, also a cylindrical wood, and is destitute of keel; contains polygalic acid 3 p. c.; yields light-colored infusion and tincture. *P. Boyki'nii*, Southern States; like the *P. alba*, only thinner, yet some consider both to be one and the same species.

2. *P. polyg'ama (rubel'la)*, *Bitter Polygala*.—The root and herb, official 1820–1880. Canada–Florida. Plant 15–22.5 Cm. (6–9') high; leaves mucronate; flowers purple; keel crested, shorter than the wings; fruit 2-seeded, capsule oblong; contains bitter principle analogous to senegin. Used as a tonic in bronchial catarrh; large doses laxative, diaphoretic. Similar to *P. ama'ra* of Europe.

## EUPHORBIACEÆ.

## 48. EUPHORBIACEÆ. Spurge Family.

U-for-bi-a'se-e. L. *Euphorbi-a* + aceæ, Gr. *Εὐφορβος*, well fed, fr. *εὖ*, well, + *φέρβειν*, to feed, after Euphorbus, physician to Juba, king of Mauritania. Trees, shrubs, herbs. Distinguished by containing acid, milky, poisonous juice; flowers unisexual; calyx usually wanting; corolla none; ovary superior, 3-celled, ovules 2 from each cell; fruit tricoccous, 3–6-seeded capsule; temperate climates, tropics; emetic, purgative, diuretic, rubefacient, poisonous, starchy food, caoutchouc, aromatic, tonic, dyes, wood, edible roots.

Genera : 1. *Hevea*. 2. *Croton*. 3. *Ricinus*. 4. *Stillingia*.

## ELASTICA. RUBBER.

*Hevea*. } The prepared milk-juice, known in commerce as Para  
several species. } Rubber.

*Habitat*. S. America—east of the Andes, near streams; India, tropics.

*Syn*. India Rubber, Caoutchouc, Resina (Gummi) Elasticum; Fr. Caoutchouc; Ger. Kautschuk, Federharz.

*He-ve'a*. L. fr. *hevê*, native name of tree in northern S. America.

*E-las'ti-ca*. L. *elasticus*, elastic, gummy—i. e., its property.

*Ca-out'chouc*. S. American name, fr. *cahuchu*.

PLANTS.—There are a number which furnish this substance, but most from *H. brasiliensis* and *H. guianensis*, which are large trees, smooth straight trunks, 15–18 M. (50–60°) high; leaves trifoliate; leaflets obovate, 10 Cm. (4') long, dark green above, lighter below; flowers in racemes. RESIN (rubber), in flask-shaped or roundish masses, or pieces with sharply incised surfaces exhibiting a laminated structure, floating on water, externally brownish-black, internally lighter, mottled; odor creosote-like; nearly tasteless; insoluble in water, dilute acids, dilute solutions of alkalis, soluble in chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene; melts at 125° C. (257° F.), remaining soft and adhesive after cooling; heated with 10 p. c. of sulphur becomes vulcanized and insoluble in all solvents; heated with 40 p. c. of sulphur, some tar, white lead, chalk, etc., yields hard rubber or ebonite. The milk-juice, a protection against predaceous animals, is obtained by gently tapping the bark with a small sharp-pointed pick, avoiding large incisions to the wood, as such invite a boring insect that quickly destroys the tree; the exuding milk (resembling that of cows') is caught in small cups fastened to the bark, which are emptied twice daily into larger vessels at the smoking station. Flat wooden paddles are dipped into the milk and then rotated in a column of smoke until coagulated, the operation being repeated until large flask-shaped masses (bolacho) are formed, being removed by a suitable incision in its upper end; sometimes paddles are dipped alternately into sand, etc., for adulteration; the freshly coagulated product is white, but soon changes to yellow, brown, and black; when allowed to concrete on the tree, it is yellowish-white; alum hastens, while ammonia retards coagulation.



SUBSTITUTIONS.—1. *Hevea dis'color*, *Castil'loa elastica*, and *C. Markhamia'na*, S. and C. America.

2. *Fi'cus elas'tica* (so-called rubber plant of hot-houses), *F. in'dica*, and *F. religio'sa*, E. India; all furnish an inferior caoutchouc.

3. *Urce'ola elastica* (Malay, climbing shrub) and *U. esculen'ta* (Penang, Borneo), furnish caoutchouc, as do many other plants.

CONSTITUENTS.—Resin (caoutchouc) 32 p. c., volatile oil, fat, wax (albumin, coloring matter).

Resin.—A solid hydrocarbon,  $C_{20}H_{32}$ , on destructive distillation yields caoutchoucine, which consists of two or more polymeric volatile oils,  $C_8H_8$ , and oil of caoutchouc; it is the elastic principle, known under the name of pure caoutchouc.

PREPARATIONS.—1. *Charta Sinapis*, 10 parts, + mustard 100. 2. *Emplastrum Adhæsivum*, 2 p. c.

Unoff. Preps.: *Liquor Caoutchouc* (Br.), 5 p. c. *Plasters*.

USES.—Woven in fabrics to compress varicose veins, hydrocele, hernia; in eczema, psoriasis, burns, ulcers, neuralgia, rheumatism, small-pox pustules. Hard rubber is used for bougies, catheters, pessaries, shields, specula, syringes, tubes, surgical instruments, etc.

## CROTON TIGLIUM. CROTON OIL PLANT.

*Oleum Tiglii. Croton Oil, official.*

**Croton Tiglium**, *Linné.* } A fixed oil expressed from the seed.

*Habitat.* India, Philippine Islands, (Ceylon, Borneo, Japan, Hindustan, Moluccas); cultivated.

*Syn.* Purging Croton, Croton Seeds, Grains Tigli, Mollucca Grains, Jamalgota, Jepak; Br. Oleum Crotonis; Fr. Huile de (Croton) Graines de Tilly; Ger. Krotonöl.

**Cro'ton.** L. fr. Gr. κροτών, dog-tick—i. e., from the resemblance of the seeds.

**Tig'li-um.** L. fr. Gr. τιλλω, to have a thin stool—i. e., its medicinal property; croton plant seeds once called *grana tiglii* or *grana tilli*.

PLANT.—Small tree, 4.5–6 M. (15–20°) high, trunk crooked; bark smooth, light brown, that of branches scarred from fallen leaves; leaves 10–12.5 Cm. (4–5') long, 5 Cm. (2') wide, glabrous, ovate, serrate, bright green, veins prominent beneath, petioles 2.5–5 Cm. (1–2') long; flowers, monœcious, racemes—staminate at upper part—pistillate at lower, greenish-white; fruit capsule, size of hazelnut, smooth, brownish-yellow, 3-celled (trilocous), each cell 1-seeded, dehiscent. Seeds, 12 Mm. ( $\frac{1}{2}$ ') long, 8 Mm. ( $\frac{1}{3}$ ') wide, ovoid, caruncle inconspicuous, raphe fine, testa thin, roughish, not shiny, brittle, gray-brown, mottled or blackish, albumin oily; integuments 33–36 p. c., kernel 64–67 p. c.

CONSTITUENTS.—Fixed oil 30–40 p. c. (from entire seeds), 50–55 p. c. (from kernels alone), proteids, albumin, etc.

*Oleum Tiglii. Croton Oil.*—Obtained from the seeds (deprived of shell or testa) by expression; it is a pale yellow or brownish, viscid, fluorescent liquid, fatty odor, mild, oily, afterward acrid, burning taste

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(taste cautiously), congeals at  $-16^{\circ}\text{C.}$  ( $3.2^{\circ}\text{F.}$ ). Applied to the skin produces rubefaction or pustular eruptions, sp. gr. 0.950, reddens litmus, soluble in ether, chloroform, carbon disulphide, fixed and volatile oils; when fresh in 55–70 parts alcohol, increasing by age—3–4 years old in 20 alcohol; contains glycerides of stearic, palmitic, myristic, lauric and oleic acids, and of the volatile acids—acetic, butyric, formic, valeric, tiglic (tiglinic—oleic series),  $\text{C}_5\text{H}_8\text{O}_2$ , also crotonol,  $\text{C}_{18}\text{H}_{28}\text{O}_4$ . The purgative principle is insoluble in alcohol; the vesicating croton-resin,  $\text{C}_{13}\text{H}_{18}\text{O}_4$ , is soluble; this latter, along with several inactive oily acids,

FIG. 233.

*Croton Tiglium.*

constitutes crotonolic or crotonoleic acid (closely related to oleic and ricinoleic acids), which together with its glyceride is believed by some to be both purgative and vesicating; it is oily, readily decomposable, slightly acid, forms salts, soluble in alcohol, severe irritant to skin and mucous membranes. Croton-resin is hard, brittle, pale yellow, soluble in alcohol, ether, chloroform, vesicating property destroyed by long boiling with solution potassium or sodium hydroxide. *Tests:* 1. Heated with 2 volumes alcohol get clear solution, which separates oil upon cooling. 2. Oil 2 Cc. + nitric acid 1 Cc., shake, should not in

any degree solidify upon standing 1–2 days (abs. of other non-drying oils). Should be kept in small, well-stoppered bottles, and handled with caution. Dose,  $m\frac{1}{2}$ –2 (.02–.13 Cc.).

**ADULTERATIONS.**—Various fixed non-drying oils, castor oil, etc.

**Commercial.**—All parts of the plant have been used in India from early times; the seeds are most active, and were introduced into Europe

in 1630, as *grana Molucca*, *grana tiglia*, etc.; the root is used natively for drastic purging in dropsy; the leaves are so acrid as when chewed and swallowed to cause inflammation of lips, mouth, throat, and alimentary canal; the wood in small doses is diaphoretic, large ones purgative, emetic. The seeds are imported mostly for the oil, which is extracted by: 1. Expression, 2. Decoction, 3. Solution (ether, alcohol, carbon disulphide, etc.), the first method being preferred. After the first pressing, the marc may be digested with alcohol at 54° C. (130° F.), then again expressed, distilling off alcohol; that extracted in India is from seeds slightly roasted to separate the shells easily, using only the kernels; this oil is pale yellow; that from Europe has shells removed without heat and kernels alone pressed; this oil is a darker reddish-brown, due to greater age of seed and higher heat used in expression.

FIG. 234.  
*Croton Tiglium*: lateral and ventral view, and longitudinal section of seed.



**PREPARATIONS.**—(Unoff.) *Linimentum Crotonis* (Br.), 12.5 p. c. *Pill.* *Emulsion.* *Tincture*; or may give on lump-sugar.

**PROPERTIES.**—Powerful purgative, irritant poison, rubefacient, all due to local action. It is drastic, causing in 1–2 hours copious watery stools. Overdoses cause intense congestion of intestinal canal, vomiting, purging, possibly death from gastro-enteritis. An alkali increases its purgative effect, which is experienced often by even smelling or rubbing the oil on the skin.

**USES.**—Mania, coma, obstinate constipation, lead colic, tæniæ, dropsies, dysentery, apoplexy, paralysis. Externally—rheumatism, gout, neuralgia, glandular swellings, pulmonary and laryngeal troubles, bronchitis, ovaritis, pleurisy. Can apply the oil directly to the surface by rubbing until dry  $m\frac{1}{2}$ –2 (.06–.13 Cc.), or the same quantity dissolved in either chloroform, olive oil, soap liniment, alcohol, ether, or oil of turpentine.

**Poisoning:** Have abdominal pain, great congestion of intestinal canal, vomiting, purging (fluid stools), pulse small and thready, skin moist, face pinched, prostration, collapse, death possibly from gastro-enteritis. Evacuate stomach, give milk, olive oil, mucilage, white of egg, gelatin, soup, opium, alcoholic liquids, artificial heat, hot poultice or fomentations to stomach, spirit of camphor, digitalis, warm stimulating baths.

**Allied Plants:**

1. *Croton Elute'ria*, *Cascarilla*.—The dried bark, official 1820–1900; Bahama Islands. Plant 1.5–6 M. (5–20°) high, stem, 2.5–20 Cm. (1–8') thick, leaves 2.5–7.5 Cm. (1–3') long, ovate, lanceolate,

**EUPHORBIACEÆ.**

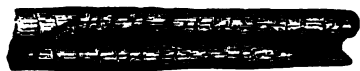
petiolate, under side bronzed-silver, flowers monœcious, white, odorous, fruit 15 Mm. ( $\frac{3}{8}$ ') thick, ovate, silvery-gray, 3-furrowed, 3-celled; bark in quills or curved pieces, 10 Cm. (4') long, 3–8 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') broad, 1–3 Mm. ( $\frac{1}{16}$ – $\frac{1}{8}$ ') thick, silvery-gray from lichen, or brown when this is absent, the exposed surface wrinkled, transversely fissured, inner surface reddish-brown, smooth, fracture short, resinous, thin whitish

FIG. 235.

*Croton Eluteria.*

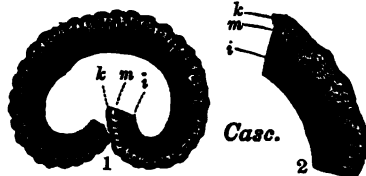
medullary rays, odor aromatic, musk-like, especially when burned, taste aromatic, bitter; contains volatile oil 1.6 p. c., cascarillin, betaine, resin 15 p. c., tannin, pectin, vanillin. Stimulant, tonic, febrifuge; intermittents, dyspepsia, diarrhœa, poor substitute for cinchona. Dose, gr. 15–30 (1–2 Gm.); tincture, 20 p. c. (alcohol 70 p. c.); dose, ʒss–2 (2–8 Cc.); extract, dose, gr. 5–8 (.3–.5 Gm.); infusions, 5 p. c., dose, ʒiv–8 (15–30 Cc.).

FIG. 236.



Cascarilla: bark quill.

FIG. 237.



Cascarilla: 1, cross-section enlarged; 2, cross-section 8 times enlarged; k, cork; m, middle bark; l, liber.

2. *C. lu'cidus*, growing with the preceding plant; *C. ni'veus* (*pseudo-chi'na*), *Copalchi Bark*, Mexico, and *C. Malam'bo*, *Malambo Bark*, Venezuela. All produce barks that resemble closely.

### RICINUS. CASTOR OIL PLANT.

*Oleum Ricini. Castor Oil, official.*

**Ricinus**  
**communis, Linné.** } A fixed oil expressed from the seed.

*Habitat.* India; cultivated in tropics; India, Italy (Spain, Sicily), United States.

*Syn.* Palma Christi, Castor Bean, Mexico Seed, Oil Plant, Bofareira, *Oleum Palmæ Christi*; Fr. *Oleum e Semini Ricini*, Huile de Ricin; Ger. *Ricinusöl*.

*Ric'i-nus.* L. a bug, dog-tick—*i. e.*, from the resemblance of the seeds.

*Com-mu'nis.* L. common, general—*i. e.*, it is the ordinary common species.

**PLANT.**—This is quite variable in habit and appearance; in tropical countries a tree 9–12 M. (30–40°) high; in warm or temperate regions only a woody bush 3.6–4.5 M. (12–15°) high; in Middle United States having herbaceous stems 1.6–3 M. (5–10°) high, hollow, smooth, glaucous, purplish bloom above; leaves with blade 15–20 Cm. (6–8') broad, palmately divided ( $\frac{3}{4}$  depth) into 7–11 lanceolate, serrate segments, smooth, bluish-green, paler beneath, on long, curved, cylindrical, purplish petioles; flowers July, monœcious, large, apetalous, racemes, staminate below, pistillate above; fruit tricoccous capsule 2.5 Cm. (1') long, blunt, greenish, deeply grooved, sometimes smooth, usually spinescent on the 3 projecting sides, 3-celled, each cell 1-seeded, which is expelled in Aug.–Sept. by capsule dehiscing into 6 valves. Seed 12 Mm. ( $\frac{1}{2}$ ') long, 6 Mm. ( $\frac{1}{4}$ ') broad, 3 Mm. ( $\frac{1}{8}$ ') thick, size of a coffee grain, with caruncle, raised raphe, grayish, marbled with blackish spots or bands of various tints and shapes, smooth, shining. In India have two varieties of seeds, *large* and *small*; the latter gives the best oil.

**CONSTITUENTS.**—Seeds consist of testa 23.82 p. c., kernel 69.09 p. c.; of this latter have fixed oil 45–50 p. c., gum (mucilage) 2.4 p. c., starch and lignin 20 p. c., albumin 5 p. c., ricinin, proteids (emulsin), sugar, ash (testa 10 p. c., kernel 4 p. c.). The poisonous principle, ricin, is an albuminoid, soluble in 10 p. c. sodium chloride solution, precipitated by acids, coagulated by heat; harmless to chickens.

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**Oleum Ricini. Castor Oil.**—Obtained from the seeds by expression; it is a pale yellowish, viscid, transparent liquid, faint, mild odor, bland, acrid, offensive taste, differing from all other fixed oils in its great solubility in alcohol and insolubility in benzin, sp. gr. 0.960, saponifies with alkalies; contains mostly ricinolein (the glyceride of ricinoleic acid),  $C_3H_5(C_{18}H_{33}O_2)_3$ , also palmitin, ricinoleic acid (ricinic acid),  $C_{18}H_{34}O_2$ ; this acid is a viscid oil which, by nitrous acid, is converted into ricinelaidic acid, crystalline, melting at  $50^\circ C.$  ( $122^\circ F.$ ).

FIG. 238.



*Ricinus communis*: a, stamen; b, anther; c, stigmas; d, transverse section of capsule; e, seed; f, embryo.

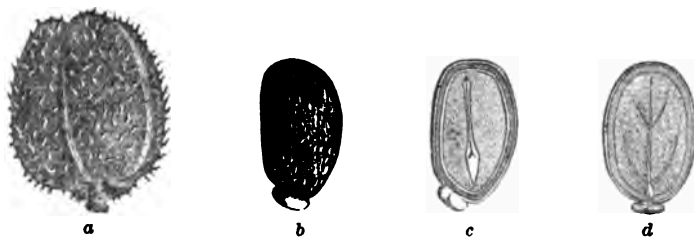
**Tests:** 1. Soluble in equal volume alcohol, glacial acetic acid, 3 volumes 92.5 p. c. alcohol (abs. of more than 5 p. c. other fixed oils). 2. Oil 3 Cc., carbon disulphide 3 Cc., sulphuric acid 1 Cc., shaken together, should not be blackish-brown (abs. of foreign oils). At  $0^\circ C.$  ( $32^\circ F.$ ) separates into crystalline flakes; at  $-18^\circ C.$  ( $-0.4^\circ F.$ ) congeals into yellow mass. Should be kept in well-stoppered containers. Dose,  $\mathfrak{zj}$ –8 (4–30 Cc.).

**ADULTERATIONS.**—Occasionally, various fixed oils and fats.

**Commercial.**—Plant called Palma Christi, from the supposed shape

of leaves resembling Christ's hand, is cultivated extensively in United States for the oil, which is extracted from the seeds by : 1. Expression ; 2. Decoction ; 3. Solvents (ether, alcohol, carbon disulphide, etc.). The first method is preferred, and consists in crushing and freeing seeds of integuments, dark skin, etc., then expressing at 60° C. (140° F.), or in heating clean seeds in shallow tanks to 65° C. (150° F.), short of scorching, thereby rendering oil more fluid, putting them into hempen bags, and expressing hydraulically between hot iron plates ; this gives the greatest yield, but an oil of inferior quality, the best being from hand-screw presses. This white oil is run into iron vats with water, boiled to separate impurities (albumin is coagulated, removed by skimming ; mucilage and starch dissolved in water) ; now strain, reboil to destroy acidity, strain ; if opaque treat with fuller's earth, or magnesium oxide 1 p. c. and animal charcoal 2.5 p. c., filter through paper and felt, put in cans or barrels—as such constitutes *cold-pressed castor oil* on the market. By grinding marc with water and expressing may obtain 6–8 p. c. additional good oil ; the yield by cold expression 25–30 p. c., with heat 35–45 p. c. The method by decoction is not so desirable,

FIG. 239.



a, ricinus fruit ; b, seed ; c and d, longitudinal sections.

as water extracts poisonous ricin, and the heat increases oil's acidity ; for this the seeds (testa or husks being removed) are crushed, boiled with water, when oil floats on top ; strain, reboil to dissipate acrid principle, strain, filter. This oil is usually brownish, acrid, irritating, and comes from E. and W. Indies. The method, by solution (ether, alcohol, carbon disulphide, etc.), causes oil to turn rancid quicker, though in France and Italy oil thus obtained is considered to be more agreeable and efficacious. The so-called popular *Italian castor oil* is produced extensively around Verona, Italy, where only fresh seeds thoroughly deprived of coating are expressed hydraulically. This oil, though equally as powerful, is remarkably free from the usual disagreeable odor and taste. An ethereal or alcoholic tincture of the seeds is claimed to be less irritating and not to nauseate. The press-cake, usually 60 p. c., is employed chiefly as a fertilizer, and as a cattle-food after removal of ricin by salt solution.

PREPARATIONS.—1. *Collodium Flexile*, 3 p. c.

*Unoff. Preps.* : *Mistura Olei Ricini* (Br.), 37.5 p. c., dose, ʒj–2 (30–60 Cc.). *Capsules. Paste.*

PROPERTIES.—Purgative, demulcent. It is non-irritating until the

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duodenum is reached, where the bile and pancreatic juice decompose it into glycerin and ricinoleic acid; this latter combines with sodium, forming sodium ricinoleate, which mildly irritates the bowels, causing purgation, stimulating muscular glands and coat, but not the liver. Acts in 4 to 6 hours, producing liquid stools without much pain or tenesmus, followed by sedative effect on intestines. Leaves are said to be galactagogue when applied to breast, and to impart cathartic power to the milk and various secretions. Glycerin increases the purgative effect.

**USES.**—Constipation, colic, diarrhoea, dysentery, enteritis in pregnancy, puerperal state, tape and lumbricoid worms, traumatic fever, renal calculi, night-sweats, amenorrhoea, engorged liver, hemorrhoids, cystitis, gonorrhoea. In dysentery may add laudanum, ℞xx (1.3 Cc.), to each dose in order to counteract any pain, tenesmus, or exhaustion from frequent passages; externally applied to warts, as a local sedative, protective.

**Administration.**—In emulsion flavored to suit, or equal quantities of oil and either heavy sarsaparilla, peppermint, or cinnamon syrup beaten together, or take with soda water, malt liquor, orange-juice, coffee, etc. All disguise very effectively the nauseating oil taste. At one time the seeds were employed, but action too violent; their griping principle (ricin) is said to reside in the embryo and testa, hence to make best oil most of these should be removed before expressing.

**Allied Plants:**

1. *Ompha'lea oleifera*, *Tambor Oil*.—C. America. Expressed from the seeds; an excellent purgative, does not gripe like castor oil.

2. *Man'ihot Manihot (utilis'sima)*, *Tapioca*.—

(See page 83.) The fecula of root (rhizome), official 1820–1880. Brazil, W. Indies. Shrub 2–2.5 M. (6–8°) high; stem jointed, petiolate leaves at upper portion, 3–5- to 7-lobed, glaucous. Root fleshy, white, tuberous, 1 M. (3°) long, weighing 20–30 pounds (9–13 Kg.). Matures in 8 months; contains poisonous (HCN) milky juice; this is pressed out and the cassava meal made into bread or washed for its starch,

which is diaphanous, muller-shaped, layers indistinct, hilum near rounded end, only half size of potato starch, which furnishes the factitious tapioca. Used as nutrient, demulcent, non-irritant for convalescence, debility, asthenic diseases, in doses ʒss–1 (15–30 Gm.), prepared with boiling water, flavored with lemon-juice, sugar, vanilla, aromatics, wine, etc.

FIG. 240.



Tapioca starch.

**STILLINGIA. STILLINGIA.**

**Stillingia**  
**sylvatica**, Linné. } The dried root.

**Habitat.** S. United States, in sandy soil, pine barrens (Virginia to Florida, Louisiana).

**Syn.** Queen's Root, Queen's Delight, Silver Leaf, Cock-up Hat, Marcory, Nettle Potato, Yaw Root; Fr. Stillingie; Ger. Stillingie.

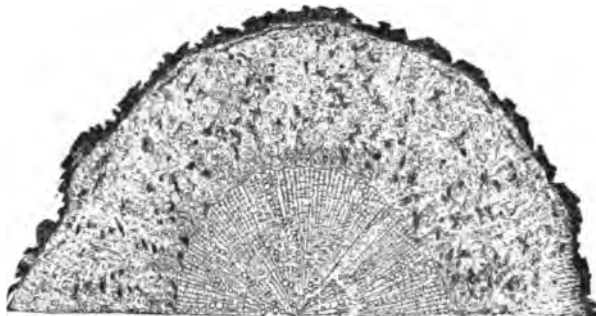


**Stil-lin'gi-a.** L. after Benjamin Stillingfleet, English botanist, author of *Miscellaneous Tracts on Natural History*, 1759.

**Syl-vat'i-ca.** L. *silvaticus*, fr. *silva*, a wood, of the woods, forests—i. e., grows in pine-barrens of the South.

**PLANT.**—Perennial lactiferous herb; stem .3–1 M. ( $1-3^{\circ}$ ) high, erect, smooth, simple; leaves lanceolate, sessile, serrate; flowers May–June, monœcious, yellow, spikes—staminate above, pistillate below, cup-shaped glands among them; fruit round capsule, rough, greenish-brown, 3-celled, each cell 1-seeded, plant when wounded emits milky

FIG. 241.



Stillingia root: magnified 10 diam.

juice. Root, slenderly fusiform, .3 M. (12') long, usually in cut pieces, of variable length, 0.5–3 Cm. ( $\frac{1}{8}$ – $1\frac{1}{8}$ ') thick, reddish-brown, longitudinally wrinkled, fracture fibrous, bark light reddish-brown, 0.5–4 Mm. ( $\frac{1}{16}$ – $\frac{1}{8}$ ') thick, spongy, finely fibrous, with many resin cells, easily separable from porous, radiate wood; odor distinct; taste bitter, acrid, pungent. Collect in late autumn or early spring. *Solvents*: boiling water; diluted alcohol. Dose, gr. 15–30 (1–2 Gm.).

**CONSTITUENTS.**—Sylvacrol, Volatile oil 3–4 p. c., resin, glucoside, fixed oil, tannin 10–12 p. c., gum, starch, ash 5 p. c.; has no alkaloid (stillingine).

**Sylvacrol.**—Acrid resin, to which pungency is due, soluble in alcohol, chloroform, benzin.

**Volatile Oil.**—Gives acrimony, odor, and taste, hence root deteriorates with age; that (oil) on the market is an ethereal extract.

**PREPARATIONS.**—1. *Fluidextractum Stillingie*. Fluidextract of Stillingia. (Syn., Extractum Stillingiæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Stillingie; Ger. Flüssiges Stillingienextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, ℥xv–30 (1–2 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 2–5 (.13–.3 Gm.). *Tincture*, dose, ʒss–2 (2–8 Cc.). *Decoction*, dose, ʒj–2 (30–60 Cc.). *Compound Syrup* (contains stillingia, corydalis, iris, chimaphila, coriander, xanthoxylum, sambucus, sugar, alcohol, and water), dose, ʒj–4 (4–15 Cc.).

**PROPERTIES.**—Alterative, antivenereal. Large doses emetic, cathartic. As alterative it is expectorant, diuretic, diaphoretic, sialagogue, cholagogue, increases heart action, circulation, and various secretions.

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**USES.**—Syphilis, scrofula, skin diseases, chronic hepatic affections, intermittents, constipation ; often associated with sarsaparilla. Popular in the South since 1800, when it was introduced by Dr. Simons.

*Allied Plants :*

1. *Stillingia sebifera*, L. *sebum*, tallow, + *ferre*, to bear.—China. Tree 6–9 M. (20–30°) high, fruit 3-celled, 3-seeded, imbedded in solid inodorous fat (palmitin, stearin), melts at 44° C. (112° F.), called China or Vegetable Tallow ; used for candles. Grows also in S. Carolina, Georgia, Florida, along seacoast.

FIG. 242.



*Mallotus philippinensis* : a, twig of staminate plant ; b, twig of pistillate plant.

2. *Euphor'bia corolla'ta*, *Flowering (Blooming) Spurge*.—The root, official 1820–1880. S. United States. Perennial herb, .6–1 M. (2–3°) high ; leaves lanceolate ; flowers umbels, 5– (3–7-) forked, white ; root many-headed, .5 M. (18') long, 5–25 Mm. ( $\frac{1}{8}$ –1') thick, blackish-brown, fissured, bark thick, white inside, sweet, bitter, acrid ; con-

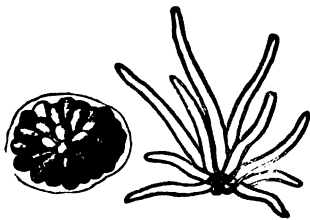
tains glucoside, resin, euphorbon; yields milky juice when punctured. Used as diaphoretic (gr. 5; .3 Gm.), cathartic (gr. 10; .6 Gm.), emetic (gr. 20; 1.3 Gm.), expectorant (gr. 2–5; .13–.3 Gm.), vesicant; in infusion, decoction.

3. *E. Ipecacuan'ha*, *Ipecac Spurge*, *Wild Ipecac*.—The root, official 1820–1880. United States. Plant resembles preceding, being a green or purple perennial, 12.5–25 Cm. (5–10') high, stem forked from the base; leaves obovate, glabrous; flowers inconspicuous; fruit angled pod, smooth; seed white, dotted; root several-headed, .6 M. (2°) long, knotty, with stem-scars, 10 Mm. ( $\frac{2}{3}$ ') thick, branched, brown, wrinkled, bark thick, white inside, sweet, bitter, acrid. Constituents, properties, and uses similar to preceding.

4. *E. pilulifera*, *Snake-weed*, *Cat's-hair*.—Australia, W. Indies. Small, branching, wayside annual; acts directly upon the heart, and respiration, to the extent sometimes of causing death. Chiefly used in asthma, chronic bronchitis. Dose, 3ss–1 (2–4 Gm.), fluidextract.

5. *Mallo'tus philippinen'sis*, *Kamala*, *Rottlera*.—The glands and hairs from the capsules, official 1860–1900; Philippine Islands, India, China. Small tree, 6 M. (20°) high; bark pale, branches with ferruginous tomentum; leaves 7.5–15 Cm. (3–6') long, petiolate, ovate, entire, coriaceous, glabrous, under side rusty; flowers dioecious, tomentous; fruit tricoccous, globular capsule, size of small cherry, externally 3-furrowed, covered with red powder. Glands and hairs (kamala) glandular, mobile, brick-red powder, inodorous, nearly tasteless; under microscope as stellately arranged colorless hairs mixed with depressed globular glands, containing numerous red club-shaped vesicles; burns like lycopodium, and ash should not be more than 4–8 p. c.

FIG. 243.



Kamala: magnified 190 diam.

Capsules when collected are rolled about in baskets, and rubbed with hands to remove glands and hairs, which in turn, passing through the meshes, are caught upon cloths; contain resins 80 p. c., rottlerin, albuminous matter 7 p. c., cellulose 7 p. c., ash 4 p. c. Tæniifuge (anthelmintic, purgative); tape-worm, sometimes for the round- and seat-worms; also externally in scabies, skin affections, herpetic ringworm. Next to male-fern for tænia, being better than koussou or turpentine. *Adulterations*: Powdered leaves, fruit-stalks, colored starch, earth, sand, in all sometimes 60 p. c., which largely increase the ash. Dose, ʒj–2 (4–8 Gm.); fluidextract, ʒj–2 (4–8 Cc.); tincture, 30 p. c. (alcoholic), ʒj–4 (4–15 Cc.); electuary; syrup; mucilage.

6. *Flemingia rhodocar'pa*, *Wars*, *Wurrus*.—Ar. for saffron. Papilionaceæ. E. Africa. This is a deep purple powder, coarser than kamala, consisting of cylindrical glands and long hairs, turning black in water, odor slight; contains flemingin (resembling rottlerin), 2 resins; used as vermifuge, in skin affections, as a dye. Many fruits, as

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Soria, Satze (Tatze), Embelia, etc., are employed as tæniifuges, in India, Abyssinia, etc., and also the bark of *Albiz'zia* (*Acacia*) *anthelmin'tica*, usually known as Mesenna, Mussena, or Busenna, the Abyssinian names for acacia bark.

## 49. ANACARDIACEÆ. Sumac(h) Family.

An-a-kar-di-a'se-e. L. *Anacardi-um* + aceæ, fr. Gr. *ând*, alike, + *καρδία*, heart—*i. e.*, fruit heart-shaped. Trees or shrubs. Distinguished by abounding in a resinous, gummy, acrid, milky juice; exhalations or juice often poisonous, latter black on drying; ovary 1-celled; styles 1–3 or none; ovules solitary with long funiculus; calyx and corolla regular, 5-lobed, rarely 3–4–7; stamens same number or double the petals. Disk present or wanting; fruit drupe or nut-like, edible; seed exalbuminous, superior; tropics; varnishes, dyes, poisonous.

Genera: 1. *Rhus*. 2. *Pistacia*.

## RHUS GLABRA. RHUS GLABRA.

*Rhus glabra*, Linné. } The dried fruit.

*Habitat.* N. America, west to California, Idaho; on barren or rocky soil.

*Syn.* Sumach, Mountain-, Dwarf-, Slick-, Smooth-, Upland-, Scarlet, or Pennsylvania Sumach, Indian salt (powder on the berries); Fr. Sumach, Sumac; Ger. Sumach.

*Rhus*'. L. fr. Gr. *ρόσιν*; Celtic *rhudd*, red—*i. e.*, color of the fruit, also the leaves of the same species in autumn.

*Gla'bra*. L. fr. *glaber*, smooth, hairless—*i. e.*, its leaves and branches.

*Su'mach*. L. fr. Ar. *summaq*—*i. e.*, their native name for the plant.

PLANT.—Woody shrub 1.5–4.6 M. (5–15°) high; stem more or less bent, dividing into many straggling branches, pith large, wood thin, white; bark smooth, grayish or reddish, with small scattered warts; leaves imparipinnate; leaflets 11–31, lanceolate, acuminate, serrate, whitish beneath, changing to a beautiful red in autumn; flowers June–July, greenish-red, terminal panicles. FRUIT, Sept., drupes in clusters of small crimson berries 3–4 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') thick, flattened-ovoid, glandular-tomentose, endocarp light yellow, smooth, shiny, enclosing a single seed; inodorous; taste acidulous, astringent. *Solvent*: Diluted alcohol. Dose, 3ss–1 (2–4 Gm.).

ADULTERATIONS.—Fruits of allied species—*R. hirta* (*typhina*—shaggy coating of long, straight hair), *R. aromatica* (smaller, less compressed, nearly spherical), *R. Coriaria* (rougher, hispid).

(*Commercial*).—Sumach grows in waste fields, along fences, woods, etc., the bark, galls, and leaves are very astringent, being collected during summer or fall for use in tanning and dyeing, while from these an extract is made containing 25–30 p. c. tannin, and this is its most convenient form for all trade and chemical purposes. For this extract sumach is cultivated in Virginia and other States.

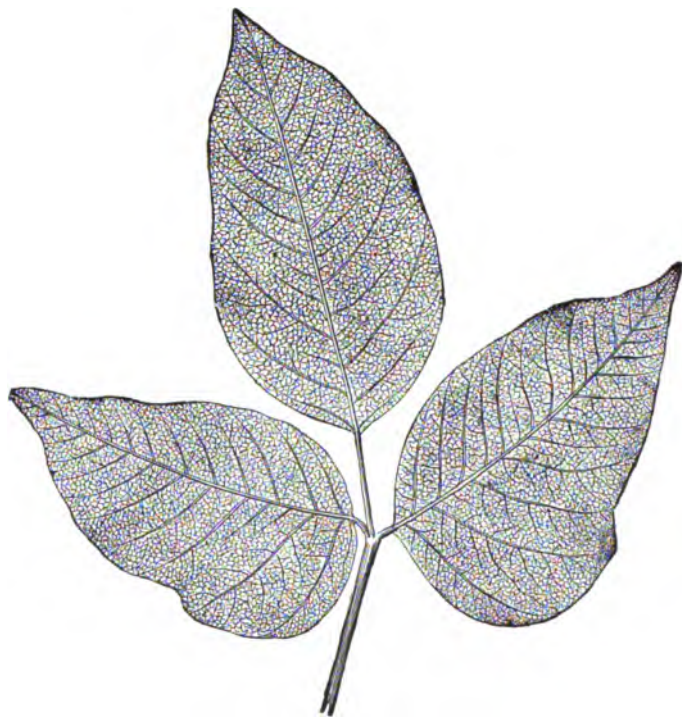
CONSTITUENTS.—FRUIT: Acid calcium and potassium malates, tannin (gallo-tannic acid) 2 p. c., gallic acid, coloring matter. SEEDS: Fixed oil. GALLS: Tannin 60–70 p. c.

PREPARATIONS.—1. *Fluidextractum Rhois Glabræ*. Fluidextract of *Rhus Glabra*. (Syn., *Extractum Rhois Glabræ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Sumac*; Ger. *Flüssiges Sumachextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with glycerin 10, diluted alcohol 90 Cc., finishing with latter alone q. s., evaporate to 100 Cc. Dose, ʒss–1 (2–4 Cc.).

*Unoff. Preps.*: *Decoction*, 5 p. c., dose, ʒj–2 (30–60 Cc.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.).

FIG. 244.

*Rhus radicans*: leaf one-half natural size.

PROPERTIES.—Astringent, refrigerant, diuretic; resembles tannin.

USES.—Catarrhal affections of stomach and bowels, pharyngitis, tonsillitis, mercurial aphthæ, spongy gums, and other mouth affections (as a gargle), ulcers, wounds, etc. (as a wash).

*Allied Plants*:

1. *Rhus aromatica*, *Fragrant* or *Sweet-scented Sumach*.—1.5–2.5 M. (5–8°) high; given in tincture, extract, and fluidextract (alcoholic), for hæmaturia, leucorrhœa, enuresis, but mainly for incontinence of urine (enuresis). Dose, gr. 10–30 (.6–2 Gm.). *R. copallina*, *Black, Dwarf*, or *Mountain Sumach*, 1–2.5 M. (3–8°) high; downy branches; leaflets entire; excels all in yield of tannin. *R. hirta* (*typhi'na*), *Staghorn*

## ANACARDIACEÆ.

*Sumach*, 4.5–9 M. (15–30°) high; hairy; leaflets serrate. All three indigenous to N. America.

2. *R. Coria'ria*, *European Sumach*.—Mediterranean Basin; leaflets elliptic, woolly, serrate.

3. *R. semiala'ta* and *R. japon'ica*.—China, Japan. These furnish galls which are used in Germany largely for obtaining tannic and gallic acids (see page 159).

The fruits of all these are red, hairy, and acidulous, while the leaves are astringent.

4. *R. rad'icans*, *Rhus Toxicodendron*, *Poison Ivy*.—The fresh leaflets, official 1830–1900, N. America. Climbing plant over fences, rocks, trees, etc.; flowers small; fruit smooth drupe. Leaflets, collected May–June, are trifoliate, petiolate, entire, glabrous, the 2 lateral nearly sessile, 10 Cm. (4') long, obliquely ovate and pointed; when dry brittle, inodorous, astringent, when fresh with acrid juice blackening on exposure, applied to skin produces swelling, inflammation, etc.—hence should not handle ungloved or confound with the harmless *Pte'lea tri-jolia'ta*, *Three-leaved Hoptree*, whose leaflets are sessile, thicker, paler green; contains toxicodendrol 3.3 p. c., tannin, acetic acid (formerly considered toxicodendric acid); toxicodendrol, the active, irritating, poisonous principle, is a viscid, non-volatile oil, agreeably odorous, soluble in alcohol, ether, chloroform, decomposed by heat. Irritant, rubefacient, narcotic, poisonous; internally produces gastro-intestinal inflammation, vertigo, nausea, muscular debility, delirium, mydriasis, convulsions, death. *Poisoning*: The fresh leaves, juice or flying pollen produces external itching, burning, redness, tumefaction, vesication, desquamation, lasting 1–2 weeks. Apply at once soap and water with scrubbing-brush, lead water, alkaline solutions (sodium bicarbonate, sulphite, chlorinated, diluted ammonia, soap-suds, alum curd), tincture or infusion of lobelia, grindelia, or sassafras, cocaine solution 4–8 p. c. (to relieve burning and itching), aristol, glycerite of phenol (carbolic acid), opium—no oils, vaselin, alcohol, these being solvents of poison serve to disseminate it, low diet, saline purgatives, quietness. Used in chronic eczema, skin diseases, erysipelas, rheumatism, incontinence of urine, etc. Dose, gr. 2–5–15 (.13–.3–1 Gm.); tincture (fresh leaves bruised and macerated with equal weight of alcohol),  $\mathfrak{M}_{\frac{1}{10}}$ –1 (.006–.06 Cc.); juice (expressed from leaves and preserved with alcohol) is soluble in ether and possesses all the virtues of the plant; fluidextract,  $\mathfrak{M}_{\text{v}}$ –30 (.3–2 Cc.).

5. *R. Toxicoden'dron*.—This properly is more or less shrubby, .6–1 M. (2–3°) high, erect, leaflets crenately lobed, pubescent, called also Poison Oak; it is merely a variety of *R. radicans*. *R. diversi'loba*, Pacific coast; leaves with 3–5-lobed, pinnatifid leaflets.

6. *R. Ver'nix* (*venena'ta*).—Canada, United States, swamps, 3–6 M. (10–20°) high; leaves of 7–13 entire leaflets; fruit yellow; called poison-sumach, -dogwood, -elder, and yields most toxicodendrol. *R. pu'mila*. S. Ca., procumbent shrub; leaves pinnate with 11 toothed acuminate leaflets; fruit red, hairy. All of these are poisonous, but *R. Ver-*

nix the most so ; when in flower, this so taints the surrounding air that sensitive persons become poisoned by simple exposure to the effluvium.

### MASTICHE. MASTIC.

**Pistacia**  
**Lentiscus**, Linné. } A concrete resinous exudation.

*Habitat.* Mediterranean Basin and islands, (Spain, France, Italy, Morocco, Greece, Turkey, Syria, Isle of Scio, Canary Islands, Somali-land, etc.).

*Syn.* Mastich Tree, Balsam Tree, Lentisk, Pistacia Galls, Resina Mastiche ; Fr. Mastic ; Ger. Mastix.

**Pis-ta'-ci-a.** L. fr. Gr. *πιστάκη*, fr. Per. *pistah*, altered from its Ar. name *foustaq*, the Pistachio tree (Dioscorides).

**Len-tis'-cus.** L. *lentiscus*, fr. *lens*, *lentis*, a lenticel, possessing lenticels or elliptical cavities in which the resin secretes.

*Mas'tic.* Gr. *μαστίχη*, for chewing, to chew, masticatory—i. e., used in the East as a chewing-gum.

**PLANT.**—Shrub or small tree, 3–4.6 M. (10–15°) high ; much branched ; bark smooth, brownish-gray ; leaves paripinnate ; leaflets 3–5 pairs, lanceolate, entire, mucronate, sessile ; flowers April–May, diceious, small ; fruit obovate drupe, 6 Mm. ( $\frac{1}{4}$ ') thick, orange-red.

FIG. 245.



*Pistacia Lentiscus* : a, staminate branch ; b, pistillate branch ; c, fruit-branch,  $\frac{1}{4}$  nat. size ; also flowers, pistil, pollen, fruit, and embryo, enlarged.

**RESIN (mastic)**, in subglobular, lenticular, elongated or pear-shaped tears, 3 Mm. ( $\frac{1}{8}$ ') long, pale yellow or greenish-yellow, transparent, glass-like lustre, surface sometimes slightly dusty, brittle, becoming plastic when chewed ; odor slight, balsamic ; taste mild, terebinthinate ; by age deepens in color and loses plasticity. *Solvents* : chloroform ; ether ; alcohol dissolves 90 p. c. of it.

## ANACARDIACEÆ.

ADULTERATIONS.—1. *Resins* from the allied species. 2. *Callitris quadrivalvis*, *Sandarac*. N. W. Africa; transparent, glass-like. 3. *Olibanum*, larger, translucent, destitute of glassy lustre. 4. *Sea salt*.

*Commercial*.—Mastic is collected in northern portions of Scio Islands from the staminate, cultivated plants; it is exported from Scio to Constantinople, Trieste, Vienna, Marseilles, England; while Greece and her other archipelago islands could furnish much, they allow it to waste. It secretes in long ducts, with elliptical cavity, located in bast layer of bark surrounded by layers of small cells, and is obtained by making longitudinal or transverse incisions into the stem and branches during June–July, whereupon juice begins slowly to exude, and is within 2–3 weeks sufficiently hard to be collected carefully in soft-lined baskets. We have two varieties: 1. *Separate tears*; collected as such on the bark; it is the best and the official kind. 2. *Agglutinated tears*; this exudes so abundantly as to run to the ground, being caught on clean tiles, rocks, etc. There are inferior kinds having tears mixed with sand, bark, and gray-brown pieces. The collection is done by women and children, and a healthy plant yields about 10 pounds (4.5 Kg.).

CONSTITUENTS.—Volatile oil,  $C_{10}H_{16}$ , 1–2 p. c., Alpha-resin (mastic(h)ic acid),  $C_{20}H_{32}O_2$ , 90 p. c. soluble in alcohol, Beta-resin (masticin),  $C_{20}H_{31}O_2$ , white, tenacious, insoluble in alcohol, soluble in ether and oil of turpentine; hot water dissolves the bitter principle.

PREPARATION.—1. *Pilulæ Aloes et Mastiches*,  $\frac{3}{4}$  gr. (.04 Gm.).

PROPERTIES.—Mild stimulant, diuretic, protective (in solution).

USES.—Bronchial and vesical catarrh, filling carious teeth (saturated solution in ether inserted with pressure, when ether soon evaporates leaving firm plug), toothache, arrests mild bleeding, masticatory to preserve teeth, fumigation. Dissolved in alcohol or oil of turpentine as a varnish (for maps, etc.), paint, etc.

*Allied Plants:*

1. *Pistacia mu'tica* (*cabu'lica*) and *P. Khin'juk*, *Bombay Mastic*.—N. W. India, Beloochistan. Resembles Scio mastic, but tears more opaque and less clean.

2. *P. Terebin'thus* (var. *atlan'tica*).—N. Africa, Algeria. Gives a resin resembling mastic.

## 50. CELASTRACEÆ. Spindle (Staff) Tree Family.

Sel-as-tra'se-e. L. *Celastr-us* + acæ. Gr. *κρίλαστρος*, holly, fr. *celas*, the latter season—*i. e.*, fruit remains on tree all winter. Trees, shrubs. Distinguished by containing an acrid principle; calyx not minute, 4–5-lobed, petals 4–5, imbricate in æstivation; stamens 4–5; ovary sessile, 3–5-celled; fruit colored, 2–5-celled pod, dehiscent, seed in pulpy aril; albuminous, superior; tropics; diuretic, tonic, laxative.

Genus: 1. *Euonymus*.



## EUONYMUS. EUONYMUS.

**Euonymus**  
**atropurpureus**, Jacquin. } The dried bark of the root.

*Habitat.* United States, Ontario to Fla., east of the Mississippi; in shady places.

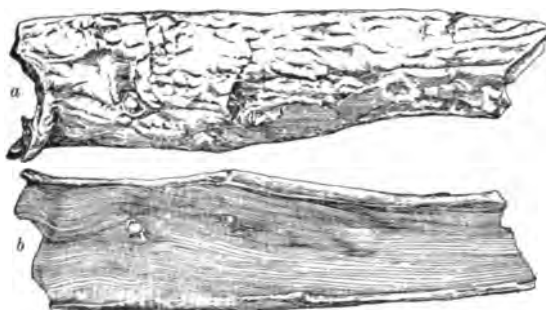
*Syn.* Wahoo, Waahoo, Wauhoo, Whahoo, Bursting Heart, Arrow or Indian Arrow Wood, Bitter Ash, Burning Bush, Pegwood, Spindle or Strawberry Tree; Br. *Euonymi Cortex*; Fr. *Ecorce de Fusain* (de Bonnet de Prêtre); Ger. *Spillbaumrinde*, *Pfaffenhütchen*.

**Eu-on'y-mus.** L. fr. Gr. *ev*, well, + *hvoμα*, name—i. e., well known for poisoning cattle.

**A-tro-pur-pu're-us.** L. *ater*, dark, + *purpureus*, purple—i. e., red flowers, crimson fruit.

**PLANT.**—Ornamental shrub 1.5–4.6 M. (5–15°) high, branches slightly quadrangular, wood white; leaves oval, serrate; flowers June, dark purple cymes; fruit Sept., capsule smooth, 4-lobed.

FIG. 246.



*Euonymus atropurpureus*: a, outer surface of root-bark; b, inner surface of root-bark, nat. size.

**BARK**, in quilled or curved pieces, 3–7 Cm. ( $1\frac{1}{2}$ –3') long, 0.5–5 Mm. ( $\frac{1}{50}$ – $\frac{1}{6}$ ) thick, outer surface ashy or pale brownish-gray, with small dark scaly patches of soft cork; inner surface whitish with projecting silky modified bast fibres; odor distinct; taste sweetish, bitter, acrid, slightly gummy; stem-bark should be rejected, occurring in long, tough strips, with dark gray or blackish fissured cork, and when powdered greenish-gray with many bast fibres—few in root-bark and of lighter color. *Solvents*: hot water; diluted alcohol. Dose, 3ss–1 (2–4 Gm.).

**CONSTITUENTS.**—Euonymin, Atropurpurin (dulcite), volatile oil 1.3 p. c., asparagin, euonic acid, (citric, tartaric, and malic acids), resins, fixed oil, pectin, bitter extractive, wax, starch, ash 14–15 p. c.

**Euonymin.**—Made by shaking diluted alcoholic tincture with chloroform; separating chloroformic solution and evaporating; purify by treating residue with ether, then alcohol and lead acetate, precipitate by hydrogen sulphide, evaporate. It is yellowish-brown, bitter, amorphous, soluble in ether, alcohol, water. The "Eclectic" resinoid *euonymin* is either brown (from root-bark) or green (from green twigs),

## GELASTRACEÆ.

both being the precipitate resulting from adding the evaporated alcoholic tincture to water; instead of this, the extract or powdered extract sometimes is used.

**Atropurpurin.**—Resembles a glucoside, but is identical with dulcete.

**PREPARATIONS.**—1. *Fluidextractum Euonymi*. Fluidextract of Euonymus. (Syn., Fluidextract of Wahoo; Fr. Extrait liquide d'Écorce de Fusain; Ger. Flüssiges Spillbaumrindenextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose, ʒss–1 (2–4 Cc.).

*Prep.*: 1. *Extractum Euonymi*. Extract of Euonymus. (Syn., Extract of Wahoo; Br. Extractum Euonymi Siccum; Fr. Extrait (d'Écorce) de Fusain; Ger. Spillbaumrindenextrakt.)

*Manufacture*: Evaporate cautiously to dryness fluidextract of euonymus 100 Cc., reduce to powder, add powdered glycyrrhiza (peeled Russian) q. s. 25 Gm., mix thoroughly. Dose, gr. 1–6 (.06–.4 Gm.).

*Unoff. Preps.*: *Infusion*. *Decoction*, 5 p. c., dose, ʒj–2 (30–60 Cc.). Euonymin (appears in action to be identical with podophyllin, only weaker), dose, gr.  $\frac{1}{2}$ –3 (.03–.2 Gm.). *Euonymin* (Eclectic), dose, gr. 1–6 (.06–.4 Gm.).

**PROPERTIES.**—Laxative, diuretic, tonic, expectorant, antiperiodic, antiparasitic.

**USES.**—Should be associated with some of the following drugs: aloes, rhubarb, colocynth, jalap, colchicum, ipecac, nitromuriatic acid, ammonium phosphate, sodium benzoate, salicylate, or phosphate; hence it increases bile flow, promotes other secretions (gastric juice, etc.), and resembles rhubarb, only milder. Useful in constipation, dropsy, torpid liver, pulmonary affections, pediculi, but overdoses cause gastro-intestinal irritation; it is excreted by the kidneys and broncho-pulmonary mucous membrane.

*Allied Plants*:

1. *Euonymus americana'us*, *Strawberry Bush*.—Low or trailing bush, with crimson capsules. *E. europæ'us*, common *Spindle-tree* of hedges, 2.5–6 M. (8–20°) high, cultivated, flowers greenish-yellow, capsules pale red, arillus orange-red; emetic, purgative. Both poisonous to cattle.

2. *Ilex verticilla'ta* (*Pri'nos verticilla'tus*), *Prinos*, *Black Alder*, *Winter-berry*.—Ilicaceæ. The bark, official 1820–1890; N. America, swamps; shrub, 2–2.5 M. (6–8°) high; leaves serrate, pubescent beneath; flowers white; fruit scarlet berry, size of pea. Bark thin, fragments 1 Mm. ( $\frac{1}{25}$ ') thick, brown-ash color, with white patches, black dots and lines; inner surface greenish, striate, bitter, astringent; contains tannin, resin, bitter principle. Used as astringent, tonic, alterative, febrifuge, substitute for cinchona; diarrhoea, fevers, ulcers, etc. Dose, ʒss–1 (2–4 Gm.), in decoction, fluidextract.

**51. SAPINDACEÆ. Soapberry(wort) Family.**

**Sap-in-da'se-e.** L. *Sapind-us* + aceæ, fr. *sap(o)* + *ind(ic)us*, Indian soap—i. e., from its saponaceous fruit. Trees, shrubs, herbs, often twining. Distinguished by presence of a saponaceous principle; ovary usually 3-celled, rarely 2-4, united at base only; leaves compound, often dotted; style undivided or 2-3-cleft; sepals and petals 4-5; stamens 8-10, distinct or monadelphous, inserted on fleshy disk; fruit fleshy or capsular; seed exalbuminous, superior; tropics; astringent; aromatic, diuretic, diaphoretic, aperient, poisonous; lumber.

Genus: 1. **Paullinia.**

**GUARANA. GUARANA.**

**Paullinia** } A dried paste consisting chiefly of crushed seeds,  
**Cupana, Kunth.** } containing 3.5 p. c. of alkaloids.

*Habitat.* N. and W. Brazil.

*Syn.* Brazilian Cocoa, Guarana Bread; Fr. Guarana; Ger. Pasta Guarana.

**Paul-lin'i-a.** L. after C. F. Paullini (1643-1712), a German botanist and writer.

**Cu-pa'na.** L. after Father Francis Cupani, Italian monk, botanist, and author; did much work on this family; died 1710.

**Gua-ra'na.** L. of native Brazilian name fr. *guaranis*, a tribe of South American Indians.

**PLANT.**—Climbing shrub; stem woody, angular; leaves imparipinnate; leaflets 2 pairs and an odd one, 12.5-15 Cm. (5-6') long, 5-7.5 Cm. (2-3') wide; flowers yellowish, spicate panicles 10-15 Cm. (4-6') long; fruit Oct., size of grape, ovoid or pyriform, 6-ribbed; seed 1-3, resembling very small horse-chestnuts, filling the fruit; arillus white, membranous; testa thin, brittle, flattish-convex, brownish-black. **PASTE** (guarana), usually in cylindrical sticks, 3-5 Cm. (1½-2') thick, or elliptical cakes, hard, heavy, dark reddish-brown, fracture uneven, often fissured in the centre, pale reddish-brown, showing numerous coarse fragments of seeds and their blackish-brown integuments; odor slight; taste astringent, somewhat smoky and pleasantly bitter, then sweetish; powder fawn-yellow color. *Solvent*: alcohol (75 p. c.). *Dose*, gr. 15-60 (1-4 Gm.).

**Commercial.**—To prepare guarana, the seeds are washed free from a mucus-like coating, dried or slightly roasted, causing the kernel to shrink from the testa, which is broken up by beating, and winnowed out; kernels are broken up in wooden mortars (hollowed stumps) and kneaded into a dough with a little water, or exposure to the dew, small amount of tapioca sometimes being added to favor cohesion, then moulded into rolls or other forms, and slowly dried by fire on wooden gratings of bamboo strips. Too rapid or irregular drying, or improper fuel used, impairs flavor, and too slow admits of moulding or fermentation.

**CONSTITUENTS.**—Caffeine (guaranine) 4-5 p. c., Tannin 26 p. c., resin, volatile oil, catechin, saponin, fat, starch, mucilage, ash 2-5 p. c.

**Caffeine.**—Obtained by boiling for a considerable time powdered

**SAPINDACEÆ.**

paste with litharge and water, adding near the end of the process a few drops of lead subacetate solution to hasten subsidence of insoluble matter ; pass hydrogen sulphide through filtered solution to precipitate lead, evaporate filtered solution to get rid of hydrogen sulphide and sulphur, then allow caffeine to crystallize out.

FIG. 247.



*Paullinia Cupana*: a. leafy branch with flowers; b. branch with ripe fruit,  $\frac{1}{4}$  nat. size; also male and hermaphrodite flowers, pistil, stamens, and fruit, enlarged.

**Tannin** (*paullini-tannic*, *catechu-tannic acid*).—Precipitates ferric salts (blackish-green), gelatin, alkaloidal and barium salts, but neither tartar emetic nor copper sulphate ; reduces silver and gold salts.

**Assay**: Exhaust 6 Gm., finely powdered drug, with chloroform 120 Cc., ammonia water 6, shake occasionally for half-hour, let stand 4 hours, filter 100 Cc., distil off chloroform, dissolve alkaloidal residue in 2 Cc. normal sulphuric acid V. S. + 20 Cc. warm distilled water, cool,

filter into separator, shake out with chloroform 20 Cc. + ammonia water 2, draw off chloroform and shake out with chloroform 10, 10; distil off chloroform from combined liquids, add to dry residue ether 2 Cc., evaporate until weight constant, which multiplied by 20 = p. c. of alkaloids present.

PREPARATIONS.—1. *Fluidextractum Guaranae*. Fluidextract of Guarana. (Syn., *Extractum Guaranae Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Guarana*; Ger. *Flüssiges Guaranaextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 3.5 Gm. alkaloids. *Assay*: To 5 Cc. in a separator, add chloroform 15 Cc., ammonia water 1 Cc., shake, draw off chloroform, shake out with chloroform 10, 10, evaporate combined chloroform solutions to dryness, and proceed approximately as in assay of guarana. Dose,  $\text{m}\text{xv}$ –60 (1–4 Cc.).

*Unoff. Preps.*: *Infusion*, 5 p. c., dose,  $\text{ʒj}$ –2 (30–60 Cc.). *Extract*, dose, gr. 2–5 (.13–.3 Gm.). *Syrup*, dose,  $\text{ʒij}$ –4 (8–15 Cc.). *Tincture* (extract 1 part + alcohol 30), dose,  $\text{ʒj}$ –4 (4–15 Cc.).

PROPERTIES.—Nervine, stimulant, tonic, astringent. Similar to coffee, tea, and maté. Produces gayety, restlessness, quick perception, wakefulness; slows pulse, impairs appetite, occasions vesical irritation.

USES.—Chiefly in nervous sick headache (migraine), such as occurs with menstruation or following a debauch, attended with bloodshot eyes and throbbing head; diarrhoea of phthisis, convalescence, tonic in general. The native Indians use the powder mixed with cassava or chocolate as a food, or suspend it in sweetened water and allow fermentation to take place, thus furnishing a very popular yellow beverage.

## 52. RHAMNACEÆ. Buckthorn Family.

Ram-na'se-e. L. *Rhamn-us* + aceæ, Gr.  $\rho\acute{\alpha}\mu\nu\omicron\varsigma$ , the buckthorn, Christ's-thorn, fr. Celtic *ram*, a tuft of branches—i. e., collection of thorns, some species thorny. Trees, shrubs. Distinguished by spiny habit; calyx 4–5-parted; petals and stamens distinct, perigynous, 4–5, opposite each other; sepals valvate; petals involute; ovary 2–5-celled, superior or inferior; fruit dry or fleshy, 2–4-celled, each cell 1-seeded; universal; acrid purgative, bitter tonic, febrifuge, dyes; fruits edible.

Genus: 1. **Rhamnus**.

### FRANGULA. FRANGULA.

**Rhamnus** } The dried bark, collected at least one year before  
**Frangula**, Linné. } being used.

*Habitat*. Europe, N. Asia; hedges, bushy places.

*Syn.* Buckthorn, Alder (European) Buckthorn, Black (Alder) Dogwood, Berry Alder, Arrow Wood, Persian Berries; Fr. *Ecorce de Bourdaine*, Bourgène; Ger. *Faulbaumrinde*.

**Rham'nus**. L. see etymology, above, of Rhamnaceæ.

**Frang'u-la**. L. fr. *frango*, *frangere*, to break—i. e., from its brittle stems—its medieval name.

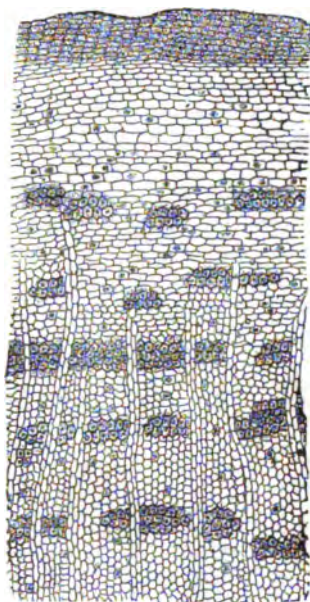
**RHAMNACEÆ.**

**PLANT.**—Slender, straggling bush, 3–4.5 M. (10–15°) high; bark smooth, purplish-gray, with white lenticels; branches not terminating in spines, not thorny; leaves oval, entire, 2.5–6 Cm. (1–2½') long, rounded at base, pointed at apex; flowers May–June, greenish to whitish-pink; fruit July, berry size of a pea, green, then white, pale yellow, pink, red, and finally black, 2–3 seeded. **BARK**, in small quills of variable length, frequently flattened or crushed, bark 0.3–1 Mm. ( $\frac{1}{75}$ – $\frac{1}{25}$ ') thick, grayish-brown to purplish-black, with numerous whitish transversely elongated lenticels and occasional patches of foliaceous lichens; inner surface smooth, minutely striated, brownish-yellow to deep brown; fracture short, purplish (outer layer), pale yellow, fibrous (inner layer); odor distinct; taste aromatic, sweetish, bitter;

FIG. 248.

*Rhamnus Frangula*: bark, natural size.

FIG. 249.

*Frangula* bark: transverse section, magnified 80 diam.

when chewed colors saliva yellow, moistened with lime water inner surface becomes red, cold water gives yellow, hot water reddish-brown infusion, which is colored dark brown, but not precipitated by ferric chloride; powder should be free from stone-cells (dis. from *R. Purshiana*), fragments colored reddish by sodium hydroxide T. S. *Solvent*: alcohol. Dose, ʒss–1 (2–4 Gm.).

**ADULTERATIONS.**—Barks of allied species.

**Commercial.**—Obtain bark in the spring from young trunks and large branches, dry carefully; should not be taken from old trunks, as that has different taste and characteristics. The emetic action of green bark is due to a hydrolytic ferment, which is destroyed either by aging or moderately heating. Owing to its various European names

—black alder, aune noir, schwarzerle, etc.—it is likely to be confused with the genus *Alnus*, to which more properly such names belong.

CONSTITUENTS.—Frangulin (rhamnoxanthin) 0.04 p. c., Emodin 0.1–2.6 p. c., Isoemodin, frangulic acid, chrysophan, resin, tannin, ash 5–6 p. c.

**Frangulin**,  $C_{21}H_{20}O_9$ .—Glucoside, obtained by macerating bark 4 days in carbon disulphide; evaporate, exhaust residue with alcohol, leaving fat behind, evaporate alcoholic solution to dryness, crystallize from ether. It is in yellow crystals, sublimable, purple by alkalis; dyes cotton, silk, wool, etc., yellow; with hydrochloric acid yields glucose and frangulic (frangulinic) acid, by hydrolysis yields emodin and rhamnose,  $C_6H_{12}O_5$ , while emodin + rhamnose = frangulin + water; thus, (1)  $C_{15}H_{10}O_5 + C_6H_{12}O_5 = C_{21}H_{20}O_9 - H_2O$ , or (2)  $C_{21}H_{20}O_9 + H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5$ .

**Emodin (Frangula-emodin)**,  $C_{15}H_{10}O_5$ .—In reddish-orange crystals, considered to be trioxymethylanthraquinone; also found in aloes, cascara, rhubarb, senna, etc.

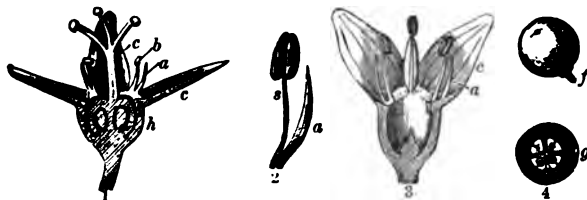
**Isoemodin**,  $C_{15}H_8O_4$ .—Bitter and laxative; fresh bark yields neither frangulin nor emodin, as these develop by age.

**Frangulic (Frangulinic) Acid**,  $C_{14}H_8O_4$ .—Glucoside, obtained by boiling alcoholic solution of frangulin with hydrochloric acid; yellowish-brown crystals, aperient like cathartic acid.

PREPARATIONS.—1. *Fluidextractum Frangulae*. Fluidextract of Frangula. (Syn., Extractum Frangulae Fluidum, U. S. P. 1890; Br. Extractum Rhamni Frangulae Liquidum; Fr. Extrait liquide (d'Écorce) de Bourdaïne; Ger. Faulbaum-Fluidextrakt, Flüssiges Faulbaumrindenextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 38 p. c., q. s., evaporate to 100 Cc. Dose, 3ss–1 (2–4 Cc.).

FIG. 250.



*Rhamnus cathartica*: 1–3, the imperfect pistillate and staminate flowers; 2, stamens—s, fertile, a, sterile; 4, f, fruit; g, cross-section of fruit.

*Unoff. Preps.*: *Extract*, dose, gr. 2–8 (.13–.5 Gm.). *Decoction*, 5 p. c., dose, 3ss–1 (15–30 Cc.). *Ointment*.

PROPERTIES.—Purgative, tonic, diuretic. When fresh, emetic, severe intestinal irritant, causing much pain, but when modified by age resembles rhubarb or senna, though milder.

USES.—In dropsy, costiveness, constipation of pregnancy (fluid-extract, Mxx (1.3 Cc.) ter die). Ointment of fresh bark for parasitic skin affections (itch, etc.).

## RHAMNACEÆ.

## Allied Plants:

1. *Rhamnus cathartica*, *Buckthorn*.—The nearly ripe fruit (berries), official 1820–1840, Europe, N. Asia, naturalized in N. America. Small tree, 3–4.5 M. (10–15°) high, short branches, thorny; leaves 2.5–5 Cm. (1–2') long, 2.5 Cm. (1') wide; flowers greenish; fruit Sept., black berries, size of a pea, green juice, 3–4-seeded; taste bitter, acrid; contains rhamnocathartin, rhamnin, tannin. Used as a cathartic; in decoction, or expressed juice made into syrup. Fresh juice with alum or lime yields the pigment *sap green*. Dose, ʒij–5 (8–20 Gm.).

2. *R. caroliniana*, *Carolina (Southern) Buckthorn*.—New York to Texas. Shrub or small tree; leaves oblong, serrate; flowers short-peduncled; fruit purple, 3-seeded.

## RHAMNUS PURSHIANA. CASCARA SAGRADA.

**Rhamnus** } The dried bark, collected at least one year  
**Purshiana**, *De Candolle*. } before being used.

*Habitat.* N. Idaho, west to the Pacific (N. California).

*Syn.* Chittam Bark, Sacred-, Persian-, Persiana or Purchiana Bark, Bearberry, Bear (Shittim) Wood; Rhamni Purshiani Cortex.

**Pur-shi-a'na.** L. of Pursh, after Frederick Pursh (L. *Purshia*), author of *Flora Americae Septentrionalis*, 1817.

**Cas'ca-ra Sa-gra'da.** L. Sp. *cascara*, bark, + *sagrada*, sacred—holy bark—i. e., so considered by many natives, on account of its medicinal properties.

**PLANT.**—Small tree, 4.5–6 M. (15–20°) high; twigs pubescent; leaves 5–15 Cm. (2–6') long, 2.5–7.5 Cm. (1–3') wide, thin, elliptic, apex obtuse, base rounded, pubescent beneath, dull green, dentate, petioles short, downy; flowers large, umbellate cymes; fruit drupe, black, obovoid, 8 Mm. ( $\frac{1}{3}$ ') long, 3-lobed, 3-seeded. **BARK**, curved, quilled, 2.5–10 Cm. (1–4') long, 1–5 Mm. ( $\frac{1}{25}$ – $\frac{1}{5}$ ') thick, outer surface reddish-brown, often more or less covered with grayish or whitish lichens, several being peculiar to this bark, and with small groups of their brownish fruit heads; inner surface yellowish-brown, darker with age, reddened by alkalies, longitudinally striate, fracture short, with projections of bast fibres in the inner bark, medullary rays with their outer ends regularly curved together to form dome-shaped groups (irregularly curved and grouped belonging to different species); odor distinct; taste bitter, slightly acrid; quills usually broken up and packed tightly by pressure for market. *Solvent*: diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—Barks of allied species: Formerly the smaller quills of *R. californica*, with medullary rays irregularly curved and grouped; in powder often find *R. Frangula*, which, owing to absence of stone-cells and its longer bast fibres, may be recognized; to this latter ammonia imparts deeper color.

**CONSTITUENTS.**—Purshianin (cascarin), Rhamnetin, Cascara-emodin 0.6 p. c., volatile oil, fixed oil, tannin, 3 resins (1, brown by potassium hydroxide, 2, purple by potassium hydroxide, 3, reddish-brown by sulphuric acid). Composition possibly changes with age; some claim the



presence of emodin, chrysarobin, and chrysophanic acid, and that from this latter the resins are derived.

**Purshianin.**—Crystalline glucoside, brownish-red, odorless, tasteless, soluble in alcohol, acetone, alkalies, hot water, resembles frangulin, but decomposes into emodin (cascara-emodin) and non-fermentable sugar; some claim it to be only impure emodin, and that this latter is not active, but that purshianin does contain the active constituent, whatever that may be; it is at least five times stronger than the drug. Dose, gr. 2–5 (.13–.3 Gm.).

FIG. 251.



*Rhamnus Purshiana* (Cascara Sagrada): A, B, flowering branches; 1, flower cluster; 2, flower, vertical section, magnified; 3, fruit.

cyrrhiza (peeled Russian) q. s. 25 Gm., mix thoroughly. Dose, gr. 2–8 (.13–.5 Gm.).

2. *Fluidextractum Rhamni Purshianæ*. Fluidextract of Cascara Sagrada. (Syn., *Extractum Rhamni Purshianæ Fluidum*, U. S. P. 1890; Br. *Extractum Cascaræ Sagradæ Liquidum*; Fr. *Extrait liquide de Cascara Sagrada*; Ger. *Flüssiges Cascara Sagradaextrakt*.)

FIG. 252.



*Rhamnus Purshiana*: transverse section, magnified 10 diam.

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 40 p. c., q. s., evaporate to 100 Cc. Dose, m<sub>x</sub>–30 (.6–2 Cc.).

3. *Fluidextractum Rhamni Purshianæ Aromaticum*. Aromatic Fluidextract of Cascara Sagrada. (Syn., Tasteless Fluidextract of Cascara Sagrada; Fr. *Extrait*

*liquide aromatique de Cascara Sagrada*; Ger. *Bitterloses Flüssiges Cascara-Sagradaextrakt*.)

**VITACEÆ.**

*Manufacture*: Macerate for 12 hours powdered cascara sagrada 100 Gm., glycyrrhiza 10, magnesium oxide 12.5 in water 200 Cc., dry at gentle heat, percolate with alcohol 50 Cc., water 25, glycerin 26, finishing with diluted alcohol q. s., evaporate to 99 Cc., add compound spirit of orange 1 Cc. Dose, ℥x-30 (.6-2 Cc.).

*Unoff. Preps.*: *Syrupus Cascaræ Aromaticus* (Br.), dose, ʒss-2 (2-8 Cc.). *Tincture*, 15 p. c., dose, ʒss-2 (2-8 Cc.). *Cordial*, dose, ʒj-2 (4-8 Cc.).

**PROPERTIES.**—Purgative, tonic, febrifuge, increases secretions of stomach, liver, pancreas; not usually given as a single cathartic, but where frequent repetition is required; it operates in 6-10 hours, and wears well, as increased quantities are not needed when habitually used; it regulates action of the bowels, and acts best when given on empty stomach in concentrated form. Fresh bark gripes, owing to a ferment which in time changes, so that matured official bark and its preparations should be without this property. The purgative action is claimed by some to be due largely to resins, tonic to bitter principle.

**USES.**—Habitual constipation due to torpor of the colon, dyspepsia, hemorrhoids.

*Allied Plant*:

1. *Rhamnus californica*.—California, Mexico. Plant, also called locally "cascara sagrada," is smaller than *R. Purshiana*, and has bark thinner, with reddish-dull-gray color; leaves elliptical, dentate; flowers numerous, abortive; fruit purple, 3-seeded.

**53. VITACEÆ. Grape Family.**

Vi-ta'se-e. L. *Vit'is* + *aceæ*, a vine; *viere*, to twist; fr. Celtic *gwid*, the best of plants, while their word *gwin* means wine. Shrubs, distinguished by climbing by tendrils, having copious watery sap, nodose joints; flowers polygamo-diœcious, calyx 4-5-toothed, petals 4-5, caducous; ovary 1, fruit 1-6-celled berry; temperate climates; astringent, stimulant, nutritious, dietetic, refrigerant, aperient, diuretic.

Genus: 1. **Vitis**.

**VITIS. GRAPE.**

1. VINUM ALBUM. White Wine.
2. VINUM RUBRUM. Red Wine.

**Vitis**  
**vinifera**, Linné. } The fermented juice of fresh fruit.

*Habitat*. W. Asia; cultivated in S. Europe, California, Ohio, etc.

*Syn*. Grape Vine, Vine, Grapes; Fr. Grain de Raisin; Ger. Weinbeere.

*Vit'is*. L. see etymology, above, of Vitaceæ.

**Vi-nif'e-ra**. L. *vinum*, wine, + *fero, ferre*, to bear, produce—i. e., its juice produces wine.

**PLANT.**—Perennial shrub; stem long, tortuous, woody, brownish; leaves 5-10 Cm. (2-4') long, roundish, 5-lobed, cordate; flowers

small, green; fruit, ovoid berry, 12–25 Mm. ( $\frac{1}{2}$ –1') thick, pericarp thin, green, yellow, purple, red, pulp juicy, greenish, sweet, acidulous; seeds few, pyriform.

**CONSTITUENTS.**—**GRAPES:** Sugar 12–30 p. c. (most in warm climates), potassium bitartrate, calcium tartrate, calcium phosphate, potassium sulphate, sodium chloride, tannic acid, malic acid, racemic acid, ferments, albumin, gluten, pectin, extractive, magnesia, alumina, silica;—argol (potassium bitartrate, tartaric acid).

1. *Vinum Album*. White Wine. (Syn., *Vinum Generosum Album*; Fr. *Vin blanc*; Ger. *Weis Wein*.) An alcoholic liquid made by fer-

menting the juice of fresh grapes, freed from seeds, stems, and skins, and subjected to the usual cellar treatment for fining and aging. It is a pale amber or straw-colored liquid, pleasant odor, free from yeastiness, fruity, agreeable, spirituous taste, without excessive sweetness or acidity, sp. gr. 0.995.

2. *Vinum Rubrum*. Red Wine. (Syn., Fr. *Vin rouge*; Ger. *Roth Wein*.) An alcoholic liquid made by fermenting the juice of fresh, red-colored grapes, in presence of their skins, and subjected to the usual cellar treatment for fining and aging. It is a deep red liquid, pleasant odor, free from yeastiness, taste fruity, moderately astringent, pleasant, slightly acidulous taste, without excessive sweetness or acidity, sp. gr. 0.995. *Assay:* Both white and red wine should contain 7–12 p. c. by weight (8.5–15 p. c. by



*Vitis vinifera*: in fruit.

volume) of absolute alcohol. *Impurities:* White Wine—Tannic acid, free acid; Red Wine—Tannic acid, free acid, acid fuchsine, red aniline colors, salicylic acid, saccharin. Should be preserved in well-closed casks, full as possible, or in well-stoppered bottles, in a cool place.

*Commercial.*—The many varieties of grapes are not all of one botanic source. Thus the majority of American wines are from the cultivated forms of *Vitis Labrus'ca*—Catawba, Concord, Isabella; while *Vitis æstiva'lis* gives us the Clinton, *Vitis cordifo'lia* or *Vitis vulpi'na* (*ripa'ria*) the Delaware, and *Vitis vulpina* the Scuppernong. On the other hand, quite all European wines are from *Vitis vinifera* varieties, which, having been introduced into California, etc., furnish us much valuable wine, in fact products difficult to distinguish from foreign vintage.

Grapes are crushed first and the clear juice, “must,” is fermented, giving light-colored wine, and, if husks, seeds, etc., be left in, dark-colored wine. The fermentation requires 2 or 3 weeks before the solution becomes clear, when it is put into other vessels, and slow

**MALVACEÆ.**

after-fermentation allowed to continue for several weeks or months, during which time considerable precipitation takes place (argol, etc.). At the end of this process it is placed into casks to ripen, and to obtain the "bouquet," which is much improved after bottling. Clarification is aided by gelatin, as this combines with tannin to form an insoluble compound and carries down with it yeast and other suspended matter. If the "must" has moderate amount of sugar, we get dry wine; if very much sugar, the fermentation ceases before it is all consumed, yielding thereby sweet wine; when bottled before the after-fermentation, the product becomes sparkling wine or champagne.

White wines are from pale yellow to deep amber, differ from the red in having very little color and tannin, and include the Sherry, Lisbon, Teneriffe, Madeira, Rhenish, Hock, Moselle, French, California, etc. When white wine is prescribed without further specification a dry domestic production should be used, such as California, Riesling, Ohio, Catawba. When red wine is prescribed without further specification a dry domestic production should be employed, such as Claret, Burgundy, etc.

**PROPERTIES.**—Stimulant, depressant, astringent, tonic, diaphoretic. The red wine contains most tannin, is more tonic and sustaining, less excitant, and is to be used solely in convalescence, excessive discharges of blood, prolonged suppuration, etc.; red wines are adulterated much more than white wines, and to the healthy are not only useless, but absolutely pernicious, unless extremely light, as some of those made in France. Wines like Sherry, Port, Madeira, etc., should not even be indulged in moderately, as they induce gout, apoplexy, dropsy, tremors, stomach and liver affections, as well as other disorders caused by over-stimulation.

**USES.**—Fevers, typhus, etc., ulceration, gangrene, tetanus, general debility, irritable stomach, debility of the aged, etc.

**54. MALVACEÆ. Mallow Family.**

Mal-va'se-e. L. *Malv-a* + *aceæ*, fem. pl. of *malvaceus*, of mallows; *malva*, mallow, fr. Gr. *μαλαχό-*, soft, mild—*i. e.*, owing to its emollient properties or soft, downy leaves. Herbs, shrubs, trees. Distinguished by stamens monadelphous, anthers 1-celled, seed reniform; flowers regular; sepals 5; petals 5; pistils several, united; albuminous, superior; temperate climate, tropics; demulcent, tough fibres, hairs as cotton.

Genera: 1. *Althæa*. 2. *Gossypium*.

**ALTHÆA. ALTHÆA.**

*Althæa*,  
*officinalis*, Linné. } The dried root, collected from plants of the second  
year's growth and deprived of periderm.

*Habitat.* Europe, Western and Northern Asia; naturalized in salt marshes, New England, New York, Australia; cultivated in Europe.

*Syn.* Marsh Mallow, White Mallow, Mortification Root, Sweetweed, Wymote; Fr. Racine de Guimauve, Guimauve; Ger. Radix Althææ, Eibischwurzel, Eibisch.

**Al-thæ'a.** L. fr. Gr. *ἀλθεῖν*, to heal, cure—i. e., its medicinal qualities (Dioscorides).

**Of-fi-ci-na'lis.** L. see (*Asagræa*) *officinalis*, page 101.

**PLANT.**—Perennial herb .6–1.3 M. (2–4°) high, having several woolly stems; leaves 2.5–7.5 Cm. (1–3') long, serrate, both sides pubescent; flowers large, 2.5–5 Cm. (1–2') in diameter, purple. Root, slenderly tapering, 15–30 Cm. (6–12') long, 10–20 Mm. ( $\frac{2}{5}$ – $\frac{1}{8}$ ') thick, traversed longitudinally by several broad, shallow furrows, separated by blunt ridges, whitish, hairy from loosened bast fibres, medullary rays narrow, vascular bundles small, indistinct, internally yellowish-white; odor faint, aromatic; taste sweetish, mucilaginous; powder contains rosette-shaped crystals of calcium oxalate and ellipsoidal starch grains; unscraped roots yellowish-brown, non-fibrous; should collect in the autumn and best from cultivated plants; leaves and flowers sometimes used. *Solvents*: water (best), when cold dissolves asparagin, mucilage, and sugar, when hot also starch. Dose, 3ss–1 (2–4 Gm.).

FIG 254.

*Althæa officinalis.*

**ADULTERATIONS.**—**ROOT**: Belladonna root, when young and peeled, resembles althæa, but distinguished by absence of hair-like bast fibres, and by possessing visible yellowish wood bundles; old dark-colored althæa roots are sometimes whitened by calcium oxide or sulphate, which subside to the bottom upon soaking in water, thereby being readily detected; root sometimes marketed cut in small cubes, rendering admixtures more likely. **POWDER**: Starchy substances recognized by shape of starch granules.

**CONSTITUENTS.**—Asparagin (althein, amido-succinamic acid, asparamide) 1–2 p. c., Mucilage (bassorin, althæa mucilage, upon which value depends) 35 p. c., Starch 37 p. c., pectin 11 p. c., betaine, sugar 11 p. c., fat 1.25 p. c., ash 4–5 p. c.

**Asparagin.**— $C_4H_8N_2O_3 + H_2O$ .—Obtained by putting the thick, viscid mucilage of althæa into a dialyzer, with water outside; asparagin passes into the water, which upon evaporation yields the crystals. These are colorless, neutral transparent, lustrous, sp. gr. 1.520, soluble in water 47 parts, acids, alkalies, converted by these latter into ammonia and organic acid; therapeutically inactive. Dose, gr. 5–10 (.3–6 Gm.).

**PREPARATIONS.**—1. *Massa Hydrargyri*, 15 p. c. 2. *Pilulæ Ferri Carbonatis*,  $\frac{1}{8}$  gr. (.01 Gm.). 3. *Pilulæ Phosphori*, 1 gr. (.06 Gm.).

*Unoff. Preps.*: Syrup, 5 p. c., dose, 3j–4 (4–15 Cc.). Decoction, 5 p. c. Ointment. Poultice. Species *Althæa* (*Emollientes*, *Pectorales*).

**MALVACEÆ.**

**PROPERTIES.**—Demulcent, emollient, protective.

**USES.**—Inflammations of pulmonary, digestive, and urinary organs, mucous membranes; skin eruptions, herpes, psoriasis, enema (decoc-tion) for vaginal and rectal irritation.

FIG. 255.



*Althæa officinalis*: 1, expanded flower; 2, vertical section of flower; 3, stamen; 4, stamen after discharge of pollen; 5, fruit; 6, outside calyx as seen from beneath.

In pharmacy, the powdered root being very absorbent, is used to harden pills, troches, electuaries, etc.

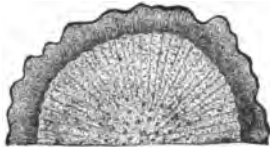
*Allied Plants:*

1. *Althæa ro'sea*, *Hollyhock*.—Levant. Petals used; formerly cultivated in gardens. Flowers (*Flores Malvæ Arboreæ*) 7.5–12.5 Cm.

FIG. 257.



FIG. 256.



*Althæa*: transverse section, magnified 2 diam.

*Malva sylvestris*: showing flowers, leaves, and fruit.

(3–5') broad, nearly sessile, composed of a tomentose calyx and 5 purple petals.

2. *Mal'va sylves'tris*, *High Mallow*; *M. vulga'ris*, *Common Mallow*, and *M. rotundifo'lia*, *Low (Running) Mallow*.—The flowers are rose-red, purple, or whitish, but when dried bluish, green with ammonia, red with acids, slight odor; sweetish, mucilaginous taste.

3. *Abu'tilon* and *Hibis'cus* species have similar medicinal properties, and may be used satisfactorily one for the other.

## RECAPITULATION No. 6.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<b>Rutaceæ:</b> 1. <i>Aurantii Amari</i> (Cortex). 2. <i>Bitter Orange Peel</i> . 1. <i>Aurantii Dulcis</i> (Cortex). 2. <i>Sweet Orange Peel</i> . 1. <i>Limonis Cortex</i> . 2. <i>Lemon Peel</i> .	<i>Citrus vulgaris</i> (amara). <i>Citrus Aurantium</i> . <i>Citrus Limon</i> Linn.	The dried rind of the fruit. The rind of the fresh fruit. The rind of the ripe fruit.	N. India.	Volatile oil (naringen, aurantiamarin), hesperidin, fixed oil, tannin, resin. Volatile oil, hesperidin. Citric and malic acids, gum, sugar.	Fluidextr., tinct., tr. cinch. co. tr. gent. co. ( <i>Oil aur. jo.</i> ), aqua, sq. fortior, syr. Syr., tinct., <i>Oil</i> : sp. comp., elix. aro., elix. i. q. s. phosph. Tinct., <i>Oil</i> : spiritus auranthii comp., sp. am. non. ar., <i>Citric acid</i> : syrup.	Stimulant, tonic, carminative, stomachic, flavor. . . . . Stimulant, flavor. . . . .	Indigestion, flatulence, corrigent to purgatives. Indigestion.	Grains. 15-30 (1-2 Gm.). Oil. m℥-5 (30-3 Cc.). Grains. 30-60 (2-4 Gm.).
1. <i>Limonis Succus</i> . 2. <i>Lemon Juice</i> .		The fresh juice.	N. India.			Refrigerant, diuretic.	Febrile inflammation, scurvy, rheumatism.	Minims. 150-300 (8-20 Cc.).
<b>Simariaceæ:</b> 1. <i>Quassia</i> . 2. <i>Quassia</i>	<i>Picrosma excelsum</i> , <i>Quassia amara</i> .	The wood.	Jamaica.	Picrosamin (quassin), resin, alkaloid, mucilage.	Extract, fluidextract, tincture.	Tonic, febrifuge, antihelmintic, bitter.	Dyspepsia, diarrhoea, constipation, loss of appetite.	Grains. 15-60 (1-4 Gm.).
<b>Burseraceæ:</b> 1. <i>Myrrha</i> . 2. <i>Myrrh</i> .	<i>Commiphora Myrrha</i> .	The gum-resin.	E. Africa.	Volatile oil, resin, gum, bitter principle.	Tincture, tr. aloes and myrrh, pill, aloes and myrrh, pill, rheum comp., mist. ferri comp.	Stimulant, tonic, expectorant, emmenagogue, vul. nervy.	Dyspepsia, amenorrhoea, anasarca, pharyngitis, diseases of the throat, leucorrhoea, etc.	5-30 (3-2 Gm.).
<b>Polygalaceæ:</b> 1. <i>Senega</i> . 2. <i>Senega</i> .	<i>Polygala Senega</i> .	The dried root.	United States.	Senegin, polygallic acid, fixed oil, volatile oil, resin, pectin, malates.	Fluidextract, syrup, syrup squill comp.	Expectorant, diuretic, diaphoretic.	Bronchitis, croup, asthma, renal dropsy, rheumatism, pneumonia, amenorrhoea.	5-30 (3-2 Gm.).
<b>Euphorbiaceæ:</b> 1. <i>Elastica</i> . 2. <i>Rubber</i> .	<i>Hevea speciosa</i> .	The prepared milk-julce.	S. America, India.	Resin, fat, volatile oil, albumin, coloring hydrocarbon, C <sub>20</sub> H <sub>32</sub> .	Charta sinapis.	Powerful purgative, irritant, rubefacient.	Fabrics, implem'ts, etc. for surgery and many appliances in the arts. Mania, constipation, dysenteria, paralysis, rheumatism, swellings, pneumonia, ovaritis, pleurisy.	Minims. 1/2-2 (10-18 Cc.).
1. <i>Oleum Tiglli</i> . 2. <i>Croton Oil</i> .	<i>Croton Tigillum</i> .	The fixed oil.	India, Philippine Islands.	Glycerides of stearic, lauric, oleic, formic, acetic, tiglinic, valeric acids, crotonol, croton-resin, croton-oleic acid.				

1. Oleum Ricini. 2. Castor Oil.	Ricinus communis.	The fixed oil.	India, Europe.	Ricinolein, palmitin, ricinoleic acid.	.....	Purgative, demulcent.	Constipation, colic, diarrhoea, enteritis, worms, fevers, calculi, amenorrhoea, cystitis, gonorrhoea.	Minims. 60-80 (4-30 Cc.).
1. Stillingia. 2. Stillingia.	Stillingia sylvatica.	The dried root.	United States.	Sylvacrol, resin, glucoside, fixed oil, volatile oil, tannin.	Fluidextract.	Alterative, anti-venereal, emetic, cathartic.	Syphilla, scrofula, skin diseases, liver affections, intermittents, constipation.	Grains. 15-30 (1-2 Gm.).
Anacardiaceae: 1. Rhus Glabra. 2. Rhus Glabra.	Rhus glabra.	The dried fruit.	N. America.	Tannin, acid calcium and potassium malate, coloring.	Fluidextract.	Astringent, refrigerant, diuretic.	Catarrhal affections, pharyngitis, aphthae.	30-60 (2-4 Gm.).
1. Mastiche. 2. Mastice.	Pistacia Lentiscus.	The concrete resinous exudation.	Mediterranean Basin.	Volatile oil, masticic acid and masticin (resins).	Pills of aloes and mastic.	Mild stimulant, diuretic.	Catarrhs, hemorrhages, fumigation, masticatory.	
Celastraceae: 1. Euonymus. 2. Euonymus.	Euonymus atropurpureus.	The dried bark of the root.	United States.	Euonymin, atropurpurin, asparagin, euonic acid, resins, fixed oil.	Extract, fluidextract.	Laxative, diuretic, tonic, antiperiodic.	Dropsy, constipation, torpid liver, pulmonary affections.	30-60 (2-4 Gm.).
Sapindaceae: 1. Guarana. 2. Guarana.	Paullinia Cupana.	The dried paste from the crushed seed.	N. and W. Brazil.	Caffeine, tannin, resin, volatile oil, fat, saponin.	Fluidextract.	Nervine, stimulant, tonic, astringent.	Sick headache, migraine, diarrhoea of phthisis, convalescence.	15-60 (1-4 Gm.).
Rhamnaceae: 1. Frangula. 2. Frangula.	Rhamnus Frangula.	The dried bark.	Europe, N. Asia.	Frangulin, emodin, isocmodin, resin, tannin.	Fluidextract.	Purgative, tonic, diuretic, emetic.	Dropsy, costiveness, constipation of pregnancy.	30-60 (2-4 Gm.).
1. Rhamnus Purshiana. 2. Cascara Sagrada.	Rhamnus Purshiana.	The dried bark.	Western U. States.	Purshianin (cascarin), rhamnetin, tannin, 3 resins, emodin.	Fluidextract, extr., aro. fluidextr.	Purgative, tonic, febrifuge.	Constipation, dyspepsia, hemorrhoids.	15-60 (1-4 Gm.).
Vitaceae: 1. Vinum Album. 2. White Wine. 1. Vinum Rubrum. 2. Red Wine.	Vitis vinifera.	Fermented juice of the fruit.	W. Asia, cult.	Albumin, pectin, tartrates, sulphates, phosphates, chlorides (K, Na, Ca, Mg), sugar.	.....	Stimulant, depressant, astringent, tonic, diaphoretic.	Fevers, debility, irritable stomach, tetanus, gangrene.	ad libitum.
Malvaceae: 1. Althaea. 2. Althaea.	Althaea officinalis.	The dried root.	Europe, W. and N. Asia (U. States).	Asparagin, mucilage, starch, pectin.	Mas. hydrarg., pii. ferri carb., pii. phosphori.	Demulcent, emollient.	Inflammations of pulmonary, digestive, and urinary tracts, skin eruptions.	30-60 (2-4 Gm.).



## GOSSYPIUM. COTTON.

1. GOSSYPII CORTEX. Cotton Root Bark.
2. GOSSYPIUM PURIFICATUM. Purified Cotton.
3. OLEUM GOSSYPII SEMINIS. Cottonseed oil.

**Gossypium herbaceum**, Linné,  
and other cultivated species.

1. The dried bark of the root. 2. The hairs of the seed, freed from adhering impurities and fat. 3. The fixed oil, expressed from the seeds and purified.

*Habitat.* C. Asia, India, China, Arabia, N. E. Africa, Egypt; cultivated in the United States, W. Indies, C. and S. America, N. Africa, Australia, S. Spain, etc.

*Syn.* 1. *Gossypii Radicis Cortex*, U. S. P. 1890; Fr. Écorce de la Racine de Cotonnier; Ger. Baumwollwurzelrinde. 2. *Gossypium*, Cotton, Absorbent Cotton, Cotton Wool; Fr. Bombyx, Lana (Lanugo, s. Pili) *Gossypii*, Coton; Ger. Gossypium depuratum, Gereinigte Baumwolle. 3. Fr. Huile (de Coton) de Semences de Cotonnier; Ger. Baumwollsaamenöl.

**Gos-syp'i-um.** L. fr. Ar. *Goz*, *Gothn*, a soft, silky substance—i. e., the hairs of the seeds.

**Her-ba/oe-um.** L. *herbaceus*, grassy, herby—i. e., the plant habit.

**PLANT.**—Small biennial or triennial shrub; stem branching, 1.5–3 M. (5–10°) high, more or less woody; leaves hoary, palmately 3–5-lobed; flowers large, 5–7.5 Cm. (2–3') long and wide, yellow, purple spot near the claw; fruit capsule or boll 4–5 Cm. (1½–2') long, 3–5-celled, opening by as many valves when ripe, revealing loose, white tuft of long, slender hair that surrounds each one of the numerous seeds.

FIG. 258.



*Gossypium herbaceum*: a, outside calyx;  
f, fruit.

**BARK OF THE ROOT**, in thin, flexible bands or quills, bark 0.2–1 Mm. ( $\frac{1}{15}$ – $\frac{1}{25}$ ') thick, yellowish-brown, longitudinally wrinkled, with small lenticels, periderm often exfoliated and somewhat fuzzy from partly detached bast fibres, inner surface whitish, longitudinally striate, fracture tough, fibrous, bast layer separable into thin laminæ; odor faint; taste slightly astringent, acrid. *Solvents*: diluted alcohol; boiling water. Dose, 3ss–1 (2–4 Gm.). **HAIRS OF THE SEED**, white, soft, fine filaments 12–37.5 Mm. ( $\frac{1}{2}$ –1½') long; under microscope hollow, flattened, twisted bands, spirally striate, slightly thickened at edges; inodorous, tasteless.

*Tests*: 1. When compressed in the hand and thrown on water, should quickly sink and impart to the water neither acidity nor alkalinity (evid. of proper purification, and abs. of fatty matter); ash should be no greater than 0.3 p. c. *Solvent*: solution of copper ammonium sulphate. **OIL OF THE SEEDS**, pale yellow, nutritious, oily liquid, odorless; bland, nut-like taste, sp. gr. 0.920,

**MALVACEÆ.**

soluble in ether, chloroform, carbon disulphide, sparingly in alcohol, particles of solid fat separate at 12° C. (54° F.), solidifies at -2° C. (28° F.). *Tests*: 1. With sulphuric or nitric acid get reddish-brown, but no coloration with olive oil; after standing 12 hours forms semi-solid mass. 2. Alcoholic solution silver nitrate added and heated gives reddish-brown color. Dose, ʒij-8 (8-30 Cc.).

**SUBSTITUTIONS.**—I. **BARK**: That from the stem sometimes employed—paler, thinner, greenish or grayish, whitish internally. II. **HAIRS**: *Bœhme'ria ni'vea*, fibre may be used for cotton, lint, etc. III. **OIL**: 1. Brazil or Para Nut Oil; nuts 2.5-5 Cm. (1-2') long, 3-edged, brownish-gray kernel, white, almond taste; yield 60 p. c. oil. 2. Oleum Fagi, Beech Oil, from fruit of *Fa'gus sylvat'ica*, kernels yield 22 p. c. oil; yellow, sp. gr. 0.922, congeals at -17.5° C. (0° F.).

*Commercial.*—Cotton was known to the Arabians, Egyptians, and Chinese in the tenth century; was carried to Spain by the Moors in the sixteenth century. Ancient Egyptians possibly did not know it, as their mummy fibres are all linen. No paintings of plants or seeds are found in tombs. In Peru, however, mummy clothing contains cotton from earliest date, hence here may be its original habitat. There are many species now giving similar products. Our own is thought to be from *G. barbadense*, Barbadoes Island, West Indies. Chapman refers long-staple or Sea Island cotton, which we cultivate, to *G. ni'grum*, and short-staple or Upland cotton to *G. al'bum*.

*The Bark* is taken from the washed roots in late fall with knives, and dried in the sun for market; sometimes the entire root is included.

*The Hairs* are taken from the seeds by hand or mill (cotton gin). As the seeds contain 15-20 p. c. fixed oil, some of this in growing is absorbed by the fibres, and must be removed before the fibres can be used for certain purposes. *Purification*: Boil carded cotton in a 5 p. c. solution of potassium or sodium hydroxide, wash with water to remove soap, express, and add to it a 5 p. c. solution of chlorinated lime, let stand for half an hour, wash, express, and add it to acidulated (HCl 5 p. c.) water, wash, express. This process may be repeated if necessary, and removes 7-10 p. c. of weight, being chiefly fat.

*The Oil* is obtained by cracking off testa, grinding kernels, and expressing; yield 15-21 p. c. At first thick, reddish-brown, turbid from mucilage and albumin; on standing most of this subsides, yielding *clarified oil* of orange color, by treating this with boiling water or superheated steam albuminoids are coagulated, giving lighter-colored *refined oil*, finally by bleaching, which consists in agitating with alkaline solution and heating, we get *winter-bleached oil*; the loss in refin-

FIG. 259.



*Gossypium herbaceum*:  
cotton fibre, magnified  
250 diam.

ing is 5–10 p. c., and thus purified it is official. It is exported largely for olive oil adulteration, to supply demand for which a line of tanked steamers ply regularly between New Orleans and Europe, the vessels having a capacity of from 500,000–1,000,000 gallons or 12,000–20,000 barrels (189–378 *ML.*).

CONSTITUENTS.—I. BARK : Chromogene (yellow, becoming red and resinous by age), resin (yellow), fixed oil, tannin, sugar, starch, gum, ash 4 p. c. II. HAIRS : Cellulose, inorganics 1.5 p. c., fixed oil 7–10 p. c. III. OIL : Olein, palmitin, linolein, glyceride of linoleic acid, and non-saponifiable yellow coloring matter.

PREPARATIONS.—I. BARK : (Unoff.) *Fluidextract* (alcohol 75 p. c. + glycerin 25 p. c.), dose, ʒss–1 (2–4 *Cc.*). *Decoction*, ʒiv (120 *Gm.*) + Oij (900 *Cc.*) evaporated to Oj (450 *Cc.*), dose, ʒij (60 *Cc.*) every half hour.

II. HAIRS : 1. *Pyroxylinum*. Pyroxylin. (Syn., Soluble Gun Cotton, Colloxylin, Collodion Cotton, Lana Collodii ; Fr. Fulmicoton soluble ; Ger. Kollodiumwolle.) A product obtained by the action of nitric and sulphuric acids on cotton.

*Manufacture* : Immerse purified cotton 100 *Gm.* in a mixture of sulphuric acid 2,200 *Cc.* + nitric acid 1,400 *Cc.* ; wash with much water, then alcohol, and press, to make it soluble in a mixture of alcohol 1 volume + ether 3 volumes ; when thus prepared, wash with cold, then boiling, water, and dry at 60° C. (140° F.). It is a yellowish-white matted mass of filaments, resembling raw cotton in appearance, harsh to the touch, exceedingly inflammable, burning rapidly when unconfined with luminous flame ; less explosive than cellulose trinitrate ; soluble in 25 parts of mixture—3 volumes ether + 1 alcohol, also in glacial acetic acid, from these precipitated by water, no residue ; consists chiefly of cellulose tetranitrate,  $C_{12}H_{16}(ONO_2)_4O_6$ . Should be kept dark, in cartons, loosely packed.

Prep. : 1. *Collodium*. Collodion. (Syn., Fr. Collodion ; Ger. Collodium, Kollodium.)

*Manufacture* : Add to pyroxylin 4 *Gm.*, ether 75 *Cc.* ; after 15 minutes add alcohol 25 *Cc.*, shake, let stand until clear.

Preps. : 1. *Collodium Stypticum*. Styptic Collodion. (Syn., Collodium Hæmostaticum, Styptic Colloid, Xylostyptic Ether ; Fr. Collodion au Tannin, Collodion styptique ; Ger. Tannin (Kollodium) Collodium.)

*Manufacture* : Agitate in a bottle tannic acid 20 *Gm.*, alcohol 5 *Cc.*, ether 25, adding finally collodion q. s. 100 *Cc.*

2. *Collodium Flexile*. Flexible Collodion. Syn., Fr. Collodion élastique ; Ger. Collodium elasticum, Elastisches Kollodium.)

*Manufacture* : Mix thoroughly in a bottle collodion 92 *Gm.*, canada turpentine 5, castor oil 3.

Prep. : 1. *Collodium Cantharidatum*. Cantharidal Collodion. (Syn., Blistering Collodion ; Br. Collodium Vesicans—Cantharidale ; Fr. Collodion (vésicant) cantharidé—cantharidal ; Ger. Spanischfliegen (Kanthariden)-Kollodium, Blasenziehendes Collodium.)

**STERCULIACEÆ.**

*Manufacture*: Percolate cantharides 60 Gm., with chloroform until exhausted, reclaim chloroform, and evaporate to 15 Gm., dissolve this in flexible collodion 85 Gm., set aside to clear. Keep all collodions in cork-stoppered bottles, remote from lights or fire.

III. OIL: 1. *Linimentum Ammoniacæ*, 57 p. c. 2. *Linimentum Camphoræ*, 80 p. c.

*Unoff. Preps.*: HAIRS: *Salicylated, borated, benzoinated, chlorinated, phenolated (carbolated), iodoform, mercuric (bi)chloride, hæmostatic cottons.* Cottonseed Tea—a mucilaginous drink for dysentery and diarrhœa.

PROPERTIES.—I. BARK: Emmenagogue, oxytocic, uterine hæmostatic; similar to ergot, but less certain. II. HAIRS: Protective. III. OIL: Demulcent, nutrient.

USES.—I. BARK: Dysmenorrhœa, amenorrhœa, uterine tumors, uterine hemorrhages, popular among negroes in Southern States for inducing abortion. II. HAIRS: Dressing in burns, scalds, erysipelas, blisters, surgical wounds; prevents entrance of organic germs that cause suppuration and septic disease. Cotton batting maintains local heat in pneumonia, rheumatism, and may be made into pessaries. III. OIL: Like olive and almond oils in pharmacy, liniments, etc.; in culinary use for lard; to adulterate olive oil, in preparing woollen cloth, morocco leather, lubricating machinery, etc.

*Incompatibles, Synergists.*—BARK: Same as for ergot.

*Allied Plants*:

1. *Gossypium barbadense*, *G. arborescens*, *G. religiosum* (fibres yellow), etc.—These furnish products which may be used similarly to the official.

**55. STERCULIACEÆ. Silk Cotton Family.**

Ster-ku-li-a'se-c. L. *Sterculia* + *aceæ*, from *stercus*, excrement, *Sterculius*—God of—i. e., named from the fetid flowers or fruit of certain species. Trees or shrubs. Distinguished from Malvaceæ by anthers 2-celled and flowers sometimes unisexual by abortion; calyx 5, corolla 5, twisted; tropics, temperate climates; demulcent, emetic, purgative.

Genus: 1. **Theobroma**.

**THEOBROMA. CACAO (CHOCOLATE TREE).**

**Oleum Theobromatis.** Oil of Theobroma, *official*.

**Theobroma** } A fixed oil, expressed from the roasted seeds.  
**Cacao, Linné.** }

*Habitat.* South America, Brazil, Central America, Mexico, West Indies; cultivated in the tropics, largely in some of the West Indies.

*Syn.* Semen (Fabæ) Cacao; Fr. Cacao, Fèves du Mexique; Ger. Kakaobohnen. Oleum Theobromæ, Butter of Cacao; Fr. Oleum Concretum e Semine Theobromæ Cacao, Beurre de Cacao; Ger. Oleum Cacao, Kakaobutter.

**The-o-bro'ma.** L. fr. Gr. *θεός*, a god, + *βρώμα*, food, food of the gods—i. e., its delicious qualities.

**Ca-ca'o.** L. Sp. from Mexican *kakahuati*—i. e., its native name.

**PLANT.**—Handsome tree 9–12 M. (30–40°) high, round branches, bark gray, smooth; leaves 20–22.5 Cm. (8–9') long, 6 Cm. ( $2\frac{2}{5}$ ') wide, lanceolate, acute, round base, entire, veins prominent beneath, petiole 2.5 Cm. (1') long, thickened at both ends; young leaves pink; flowers pale pink, calyx and corolla 2.5 Cm. (1') broad, alike in color; fruit large, 15–17.5 Cm. (6–7') long, broadly fusiform, with 10 shallow furrows and blunt ridges, tuberculated, pendulous, single or 2–3 together, at first yellow, then red, purple, pericarp thick, tough, 5-celled; seeds many, closely packed in tiers, size of almonds, angular from pressure, immersed in copious, sweet buttery pulp, seed-coats 2, brownish.

FIG. 260.

*Theobroma Cacao.*

**CONSTITUENTS.**—SEEDS: Fixed oil 50 p. c., starch 16 p. c., theobromine 1.5–4.5 p. c., caffeine, proteids 18 p. c., sugar 0.6 p. c., coloring matter, ash 3.6–4.6 p. c.

**Oleum Theobromatis. Oil of Theobroma.**—The seeds taken from the fruit and dried retain astringency and bitterness; these properties may be overcome by roasting, or allowing to sweat and ferment in heaps for a week, or burying in a box for 3 days, then drying. The oil is now extracted by: 1. Expression; 2. Decoction; 3. Solvent (alcohol, ether, carbon disulphide, chloroform, etc.). The first process is considered best, and consists in removing the shells, heating the kernels to 70° C. (158° F.), subjecting them to hydraulic pressure between hot iron plates or rollers, and running the oil into rectangular moulds, where it soon congeals; the remaining dryish, oleaginous pulp (expressed cake), retaining a small amount of oil, is utilized as chocolate. Oil is a yellowish-white solid, faint, agreeable odor, bland chocolate-like taste, sp. gr. 0.975, melts at 30–35° C. (86–95° F.), soluble in ether, chloroform, benzene, 100 parts alcohol, lighter-colored by age;

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contains stearin (40 p. c.), palmitin, laurin, small amounts of glycerides of acetic, butyric, formic, linolic, and arachidic acids. *Test*: 1. Oil 1 Gm. + 3 Cc. ether in test-tube at 17° C. (63° F.); when dissolved plunge into water at 0° C. (32° F.), the liquid should not become turbid, nor deposit white flakes in less than 3 minutes, and after congealing should clarify at 15° C. ; 59° F. (abs. of wax, stearin, tallow, etc.). Dose, 3ss–1 (2–4 Gm.).

**PREPARATIONS.**—(Unoff.) *Emulsion. Suppositories. Ointments.*

**PROPERTIES.**—Nutrient, demulcent, emollient.

**USES.**—Seldom internally, only as suppositories, when it acts as an excipient or carrier for other medicine. Externally in cosmetic ointments, pill coating, abraded or inflamed surfaces.

*Allied Products:*

1. *Chocolate, Cocoa.*—In every 100 parts of seeds 12 are shells, 88 are kernels; now the expressed cake, preferably from seeds, having been deprived of testa before pressing, when reduced to paste, mixed with sugar, vanilla, cinnamon, etc., annatto for coloring, and moulded into cakes, constitutes commercial *cacao, cocoa, or chocolate* (fr. *Indian chocolat*). To this sometimes are added starch, rice flour, butter, lard, barley flour, sassafras nuts, cloves, etc., mainly as adulterants.

2. *Theobromine* (dimethylxanthine),  $C_7H_8N_4O_2$ .—To obtain this, exhaust kernels with hot water, strain, precipitate with lead acetate, filter, remove lead by hydrogen sulphide, filter, evaporate, now treat residue with hot alcohol, from which whitish bitter crystals deposit. It is an alkaloid not altered by solution of potassium hydroxide, slightly soluble in water, alcohol, ether, forms salts (hydrochloride, nitrate, salicylate, etc.), and is related to caffeine, this latter being its methyl derivative—methyltheobromine, into which theobromine may be converted by treating theobromine silver with methyl iodide.

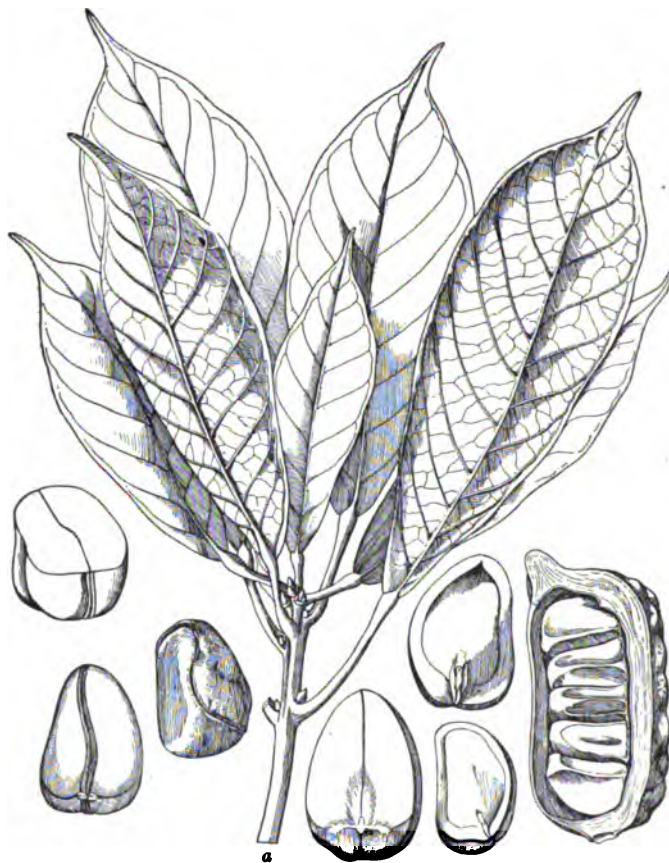
Theobromine is made also synthetically from xanthine (ureous acid); the salt, *sodio-theobromine salicylate* (diuretin), containing 49.7 p. c. of this alkaloid, is a stimulant and diuretic in chronic and acute Bright's disease, the dose being gr. 10–20 (.6–1.3 Gm.) ter die in capsule or solution.

*Allied Plant:*

1. *Co'la acumina'ta, Cola, Kola-nut.*—The recent or dried cotyledons, W. Africa, W. Indies; cultivated. Tree 15–20 M. (50–65°) high, smooth stem, leaves 15–20 Cm. (6–8') long, lanceolate-ovate, acuminate, flowers, staminate and pistillate, yellowish, fruit yellowish-brown, 5 segments, rough, woody, follicle 10–13 Cm. (4–5') long, each segment 1–3-seeded; seed 3–4 Cm. ( $1\frac{1}{5}$ – $1\frac{3}{5}$ ') long, 2–3 Cm. ( $\frac{4}{5}$ – $1\frac{1}{5}$ ') thick and wide, oblong-ovate, somewhat flattened or angular from mutual pressure, rounded on one side, and this irregularly infolded upon the other, brownish, mottled with blackish spots, yellowish-white inside, cotyledons of different size, thick, variously bent, odor nutmeg- or rose-like, taste aromatic, astringent; contains caffeine (kola-tannate) 2.7–3.6 p. c., theobromine, starch 34–42 p. c., tannin, kola-red, vola-

tile oil, etc. Stimulant, tonic, nervine, diuretic, astringent, similar to coffee, but resembles coca in aiding the endurance of fatigue without food; neuralgia, headache, migraine, diarrhoea, indigestion, weak and

FIG. 261.



*Cola acuminata*: a, leafy branch,  $\frac{1}{4}$  nat. size; also longitudinal section of fruit, cross and natural longitudinal section of seed showing embryo enlarged.

irregular heart. Dose, gr. 15–30 (1–2 Gm.); fluidextract; tincture, 15 p. c. (diluted alcohol), dose, ʒj–2 (4–8 Cc.); elixir, 8 p. c., dose, ʒj–3 (4–12 Cc.).

#### 56. THEACEÆ (TERNSTRÖEMIACEÆ). Tea Family.

The-a'se-e. L. *The-a* + aceæ, tea, fr. Chinese *Téh* or *Toha*—i. e., native name simulating *Dea*, God. Trees, shrubs. Distinguished by alternate leaves; large showy solitary axillary flowers, sepals 5, petals 5, crenulate, stamens monadelphous; ovary 2–several-celled, superior; fruit 3–5-celled, woody capsule, dehiscent; tropics; stimulant, astringent, sedative.

Genus: 1. *Thea*.

## THEA. TEA.

**Caffeina, Caffeine (Theine),**  $C_8H_{10}N_4O_2 + H_2O$ , *official*.

**Thea chinensis, Linné,**  
and  
**Coffea arabica, Linné.** } A feeble basic proximate principle from the dried leaves of the former, and dried seeds of the latter (Rubiaceæ), and found also in other plants.

*Habitat.* S. E. Asia, China, India, Japan; cultivated.

*Syn.* Thea Bohea, Black Tea, Thea viridis, Green Tea; Fr. The; Ger. Thee.

*The'a.* L. see etymology, page 418, of Theaceæ.

*Chi-nen'sis.* L. (Sinensis) Chinese, of or belonging to China—i. e., its chief habitat.

**PLANT.**—Evergreen shrub, much branched, bark brown, young twigs downy; leaves 5–10 Cm. (2–4') long, petiolate, acute at both ends, oval, irregularly serrate, veins prominent, dark green; flowers in winter, 2.5 Cm. (1') wide, yellowish-white; fruit 3-celled trigonous capsule, with thin brown woody pericarp; diluted alcohol or boiling water exhausts the leaves. Dose, ʒj–2 (4–8 Gm.).

FIG. 262.

*Thea chinensis.*

**ADULTERATIONS.**—Prussian blue, indigo, turmeric, gypsum; the three first impart color to water, the last soon deposits; various leaves, recognized by shape, venation, margin, etc.



*Commercial*.—The plant, springing from seed, begins to yield satisfactory leaves in 3 years, and at 7 attains perfection, being about the height of a man. Three collections are made yearly (Feb., Apr., June), the first, consisting mostly of young leaves, having greatest value. Commercially we have *green* and *black*, the former being collected more carefully and quickly dried, the latter, owing to slower process, undergoing partial fermentation, thereby changing color and impairing quality.

*CONSTITUENTS*.—Caffeine (Theine) 1–5 p. c., volatile oil 0.6–1 p. c., theophylline (isomeric with theobromine), tannin 11–21 p. c., boheic acid, albumin, resin, wax, ash 4–6 p. c. (14 p. c. being phosphoric acid); leaves yield 40 p. c. of aqueous extract.

*PREPARATIONS*.—(Unoff.) *Fluidextract*, dose, ℥xv–60 (1–4 Cc.). *Infusion (Tea)*, dose, *ad libitum*.

*PROPERTIES AND USES*.—Similar to coffee, under Rubiaceæ, which see.

*Allied Plants:*

1. *Thea* (*Camellia*, after George Joseph Camel or Camelli, a Dutch Jesuit missionary and botanist) *japonica*.—Japan. An ornamental shrub with poisonous seed. *T. oleosa* (*Camellia oleifera*) and *T. drupifera*. Seeds resemble those of *T. chinensis* and yield a bland fixed oil, that of *T. drupifera* being fragrant.

2. *Plex paraguayensis* (*paraguayensis*), *Maté*, *Paraguay Tea*.—Ilicaceæ (Aquifoliaceæ). Brazil. Leaves contain caffeine 0.2–1.6 p. c., tannin 10–16 p. c., volatile oil, stearopten, wax, glucoside, proteids 5 p. c., ash 4–8 p. c.

3. *Helianthemum canadense*, *Frostwort*.—Cistaceæ. The herb, official 1850–1880; N. America. Perennial, 15–45 Cm. (6–18') high, hoary; leaves 2.5 Cm. (1') long, woolly beneath; flowers 2.5 Cm. (1') broad, yellow, 5's, calyx pubescent, bitter, astringent; contains tannin 11 p. c., bitter glucoside. Used as a tonic, astringent, alterative for scrofula, syphilis, diarrhoea; gargle in scarlatina, sore throat; prurigo; large doses emetic. Dose, gr. 5–30 (.3–2 Gm.); in decoction, infusion, extract.

**57. GUTTIFERÆ (CLUSIACEÆ). Gamboge (Mangósteen)**  
**Family.**

Gut-tif'e-re. L. fem. pl. *Guttifer*—*gutta*, a drop, + *ferre*, to bear—i. e., plants yield gum or resinous substances (juice) in drops. Trees or shrubs, allied to Hypericaceæ and Malvaceæ. Leaves coriaceous; flowers perfect; stamens many, distinct, mon- or poly-adelphous; sepals 2–8, often unequal, petaloid; petals 2–8 +; ovary 1-celled, superior; fruit edible; seed oily; tropics; purgative, timber.

Genus: 1. *Garcinia*.

GUTTIFERÆ.

## CAMBOGIA. GAMBOGE.

**Garcinia**  
**Hanburii**, *Hooker filius.* } A gumresin.

*Habitat.* Annam, Camboja (Cambodia), Siam, Cochin-China.

*Syn.* Gummi-resina Guttæ or Gutti, Gutta Gamba, Cambodia; Fr. Gutte, Gomme-gutte; Ger. Gutti, Gummigutt.

**Gar-cin'i-a.** L. named after Laurent Garcin, French botanist, who first described it in 1734.

**Han-bu'ri-i.** L. in memory of D. Hanbury, named by Sir J. D. Hooker.

**Cam-bo'gi-a.** L. usually called Cambodia, a French protectorate in farther India, where it is indigenous.

*Gamboge.* The trade name, corruption of Camboje.

**PLANT.**—A tree 10.5–15 M. (35–50°) high, with many spreading branches; bark orange-brown, thick; leaves 10–17.5 Cm. (4–7') long, laurel-like; flowers Feb., dioecious, small, yellow, in 4's, staminate ones on pedicels (*pedicula'ta*) 6 Mm. ( $\frac{1}{4}$ ') long; fruit May–June, size

FIG. 263.

*Garcinia Hanburii.*

of crab apple, 3 Cm. ( $1\frac{1}{5}$ ') in diameter; smooth, orange-green color, with 4 dissepiments, each having 1 seed 12–18 Mm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') long. **GUMRESIN** (gamboge), in cylindrical pieces, straight or bent, solid or

usually hollow, 15–20 Cm. (6–8') long, 2.5–5 Cm. (1–2') thick, longitudinal striæ, fracture conchoidal, waxy lustre, orange-brown, somewhat porous; inodorous; taste acrid; powder bright yellow, sternutatory, with few or no starch grains; not more than 25 p. c. should be soluble in alcohol. *Solvents*: alcohol or ether extracts at least 75 p. c. Dose, gr.  $\frac{1}{2}$ –5 (.03–.3 Gm.).

**ADULTERATIONS.**—Wheat and rice flour, sand, powdered wood or bark, mostly in the cake variety, giving greater hardness and coarser fracture.

**Commercial.**—Gamboge as it first comes from the tree is a yellow, milky juice, which is secreted in latex-tubes (ducts) of the middle bark and to a less extent in the pith, alburnum, leaves, flowers, and fruit. It is collected by breaking off leaves and twigs of the tree, or by single, deep incisions through the bark, arranged spirally around the trunk from the ground upward a number of feet, from which injured points the juice exudes in drops; it is caught on leaves or in coconut shells or in bamboo joints, where it is allowed to harden during summer. Each tree yields biennially 3 bamboo joints 50 Cm. (20') long, 4 Cm. (1 $\frac{3}{4}$ ') thick. Trees should be tapped only in alternate years.

We have several commercial varieties, depending upon their shape, which enter market via Canton, Calcutta, Singapore, Saigon, Bangkok, etc.

1. *Pipe* or *Roll*.—This is the best, and results when the juice is caught in hollow bamboo joints, placed at the lower end of the incisions; it requires a month to dry, and in doing so contracts toward the sides, leaving a central cylindrical cavity.

2. *Cake* or *Lump*.—This is in masses of 2–3 pounds (.7–1 Kg.), usually somewhat mixed with sticks, flour, etc., and results from the juice being caught in leaves and various vessels, during which more or less exposure occurs; it is less uniform, less brittle, fracture dull or brownish, non-conchoidal, sometimes called *Saigon*, *Cochin*, *coarse gamboge*. *Tests*: 1. When pure the gumresin is dissolved completely by successive treatments with ether or alcohol, and then water. 2. Rubbed down with hot water yields yellow emulsion, when boiled with water, cooled, and iodine T. S. added, should not get green coloration (abs. of starch, flour, etc.).

**CONSTITUENTS.**—Gum 16–25 p. c., resin (cambogic acid) 66–80 p. c., volatile oil, phenol ester, methyl alcohol and other alcohols, isovitinic and acetic acids, liquid with fruity odor resembling an aldehyde or ketone, ash 1–3 p. c.

**Gum.**—Soluble in cold water like gum arabic (*arabin*), but not identical with it, as it is not precipitated by lead acetate, ferric chloride, sodium silicate, or sodium borate.

**Resin.**—Soluble in ether and alcohol, forming golden-yellow tinctures, also in alkaline solutions with red color, from which it is precipitated unaltered by acids. It has acid characteristics, hence sometimes called cambogic acid, and upon it the coloring matter and medicinal properties depend; with salts of heavy metals forms precipitates called cambogiates.

**GUTTIFERÆ.**

PREPARATIONS.—1. *Pilulæ Catharticæ Compositæ*,  $\frac{1}{4}$  gr. (.016 Gm.).

Unoff. Prep.: *Pilula Cambogiæ Composita* (Br.), 16 p. c. +, dose, gr. 4–8 (.26–.5 Gm.).

Poisoning: Similar to aloes, colocynth, elaterin, etc.

PROPERTIES.—Drastic, hydragogue cathartic; in small repeated doses diuretic. Usually produces much griping, nausea and vomiting when taken in full doses, so that generally it is combined with other cathartics, as calomel, jalap, potassium bitartrate or carbonate, etc.; it greatly irritates the alimentary canal, especially the small intestine, when taken in excess, and 60 grains (4 Gm.) have occasioned death; it augments intestinal glands' secretion, but not of bile, and mostly passes in the feces, but some is absorbed, causing yellow urine.

USES.—Liver, trouble from malaria; renal dropsy, uræmic conditions, congestion of the brain, tæniifuge (combined usually with tænicides), vermifuge, dropsy; very uncertain in veterinary practice. Mostly used as pigment in water-color painting. The powder when rubbed up with water shows strongly the "Brownian movement" under the microscope.

*Allied Plants:*

1. Several guttiferous plants of Southern India, not restricted, however, to the Cambodia province, as is the official, are almost identical with this latter and yield a similar juice: *Garcinia Morell'la* (staminate flowers sessile), Ceylon, S. India; *G. travanco'rica*, Travancore; *G. picto'ria*, Madras peninsula, etc.; *G. Mangosta'na*, Mango Fruit, India, astringent; *G. purpu'rea* (*in'dica*) India; the seeds of this are exposed to the sun and then boiled in water, when 10–20 p. c. of a fixed oil (kokum-butter) is obtained.

2. *Canell'la Wintera'na* (*al'ba*), *Canellæ Cortex*, *White Cinnamon*. —Canellaceæ. The bark, official 1820–1880; W. Indies. Tree 9–15 M. (30–50°) high, recognized by whitish bark; leaves thick; flowers white, aromatic; fruit berries 12 Mm. ( $\frac{1}{2}$ ') long, blackish. Bark in quills 15–60 Cm. (6–24') long, 2–4 Cm. ( $\frac{4}{5}$ –1 $\frac{3}{5}$ ') in diameter, the bark 3 Mm. ( $\frac{1}{8}$ ') thick, deprived of gray corky layer, orange-red, with scars, inside striate with resin-cells, cinnamon odor; taste bitter, biting; contains volatile oil (having eugenol) 1 p. c., resin 8 p. c., bitter principle. Used in gastric debility, menorrhagia, amenorrhœa, as stimulant, tonic, condiment. Dose, gr. 5–30 (.3–2 Gm.). *Pulvis Aloes et Canella*, *Hierapicra*, official 1820–1850.

3. *Vio'la tri'color*, *Pansy*. —Violaceæ. The flowering herb, official 1880–1890; Europe, N. America, cultivated. Plant 10–30 Cm. (4–12') high, angular; leaves roundish, cordate; flowers variegated (yellow, whitish, blue, purplish); taste bitter; contains salicylic acid 0.1 p. c., bitter



FIG. 264.

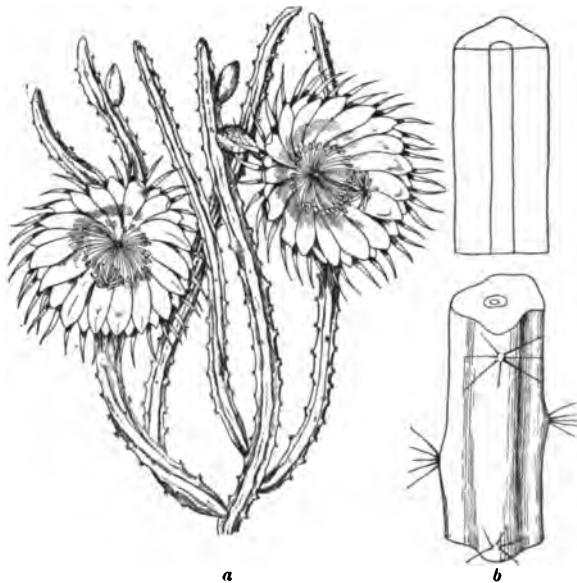
*Viola tricolor.*

principle, resin. Used in skin diseases, scrofula, syphilis, bronchitis, nephritis, as alterative, expectorant; large doses emetic, cathartic. Dose, gr. 15–60 (1–4 Gm.); in decoction, infusion, extract. *V. pedata*, *Bird's-foot* or *Blue Violet*. The herb and rhizome, official 1820–1880; Europe, N. America. Plant acaulescent; leaves 3–5-divided; flowers bluish; rhizome 25 Mm. (1') long, 18 Mm. ( $\frac{3}{4}$ ') thick, bitter, acrid. Used as the preceding.

4. *Tur'nera diffu'sa* (*microphyl'la*) var. *aphrodisi'aca*, *Damiana*.—Turneraceæ. The leaves; W. Mexico, Lower California, Texas. Leaves alternate, 10–25 Mm. ( $\frac{1}{2}$ –1') long, wedge-shaped base 6–12-toothed, obovate, light green, with whitish hairs, aromatic; mint-like taste; contains volatile oil 1 p. c. (amber-colored, aromatic odor, warm camphoraceous taste), damianin, 2 resins, tannin. Aphrodisiac, tonic, stimulant, laxative. Dose, 3ss–2 (2–8 Gm.), fluidextract.

5. *Ce'reus* (*Cac'tus*) *grandiflo'rus*, *Night-blooming Cereus*.—Cactaceæ. The recent stem and branches, collected when plant is in flower. Mex-

FIG. 265.



*Cereus grandiflorus*: a, flowering stem; b, section of stem, showing cross and longitudinal sections.

ico, W. Indies; cultivated. Small shrub, .3–1 M. (1–3°) high, stem green, fleshy, branching, 5–6-angled, angles 6–8-spined, flowers white, sessile, large, fragrant, opening at night, petals and stamens numerous, fruit white berry, size of an egg, acrid taste; contains cactine, acrid resinous glucoside, resins. Cardiac stimulant (tonic), diuretic, similar to digitalis, but non-cumulative, counter-irritant; cardiac palpitation and weakness, heart failure from valvular disease, angina pectoris, aortic regurgitation, dropsies, low fevers, Graves' disease, tobacco, toxæmia,

**THYMELÆACEÆ.**

sexual exhaustion. Dose, gr. 5–10 (.3–.6 Gm.); fluidextract; tincture (alcohol), 25 p. c., dose, ℥xv–30 (1–2 Cc.); decoction, 5 p. c., dose, ʒj–2 (4–8 Cc.).

6. *Lophoph'ora (Anhalo'nium) Lewin'ii, Mescale.*—Mexico. This small plant yields the mescale buttons, which are used by the Rio Grande Indians to produce intoxication during religious ceremonies, also the alkaloid pellotine (pellotinum),  $C_{15}H_{21}NO_3$ . This latter is unirritating, consequently may be well employed hypodermically as a hypnotic; resembles somewhat cannabis indica. Slightly slows the pulse, produces mental and bodily weariness, sleep without untoward symptoms; excessive quantities produce spasms resembling strychnine-poisoning. Hysteria, insomnia, angina pectoris, asthmatic dyspnœa, hypochondriasis. Dose, (pellotine) gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

**58. THYMELÆACEÆ. Mezereon Family.**

Thim-e-le-a'se-e. L. *Thymelæ-a* + acæ, Gr. *θυμελαία*, a plant, fr. *θύμος*, courage (thyme), + *ἐλαία*, olive tree (oil), referring to the reviving odor; or *θύω*, to perfume, being used in temples as incense. Trees, shrubs, rarely herbs. Distinguished by toughness and acidity of bark, due to bast fibres. Leaves entire; flowers perfect; calyx regular, simple colored, 4–5-lobed, inferior; stamens perigynous, twice the calyx lobes; ovary 1-celled, superior; ovule 1; fruit nut or drupe; tropics; narcotic, poisonous.

Genus : 1. *Daphne*.

**MEZEREUM. MEZEREUM.****Daphne**

*Mezereum*, Linné, } The dried bark.  
and other European species. }

*Habitat.* Europe, mountainous regions, (Siberia, spontaneous in Canada, New England; cultivated for medicine and ornament).

*Syn.* Mezereon, Spurge Laurel (Olive), Spurge Flax, Lady Laurel, Wild Pepper; Br. Mezerei Cortex, Cortex (Thymelææ) Coccognidii; Fr. Écorce de Mézéréon, de Garou, de Lauréolé, de Thymélee, Bois gentil; Ger. Seidelbast, Kellerhals (rinde).

*Daph'ne.* L. fr. Gr. *δάφνη*, the laurel or bay tree, into which a nymph, beloved of Apollo, was metamorphosed; lit. fr. *δαίω*, to burn, + *φωνή*, a sound—i. e., it crackles when burning.

*Me-ze're-um.* L. medieval name fr. Pers. *mazuriyum*, which then was applied to species of *Daphne*.

**PLANT.**—Small, slender, straggling shrub, .3–1.3 M. (1–4°) high; stem branching, smooth, but young branches tomentose; leaves 5–7.5 Cm. (2–3') long, lanceolate, blunt, entire, smooth, dark green; flowers Feb.–April, in small clusters, sessile, rose-red color, fragrant, tubular 18 Mm. ( $\frac{3}{4}$ ') wide; fruit July, ovate, 9 Mm. ( $\frac{3}{8}$ ') long, sessile, bright red, succulent. **BARK**, in long, thin, flexible, tough bands, .6–1.3 M. (2–4°) long, 12 Mm. ( $\frac{1}{2}$ ') broad, 1 Mm. ( $\frac{1}{16}$ ') thick, folded or rolled into disks, edges fringed with partly detached bast fibres, yellowish- or reddish-brown, obliquely striate or wrinkled, numerous lenticels, and occasional brownish-black fruit-heads of a lichen; inner surface yellow-

ish-green or whitish, satiny-lustrous, finely striate, fracture tough, fibrous, the periderm readily separable from the yellowish-green cortex, inner bark lamellated; odor slight; taste very acrid. *Solvents*: boiling water; alcohol. Dose, gr. 1-10 (.06-.6 Gm.).



*Daphne Mezereum.*

*Commercial.*—The U. S. Pharmacopœia recognizes several other species of *Daphne* besides *D. Mezereum*. These are chiefly *D. Laure'ola*, *Spurge Laurel*; and *D. Gnid'ium*, *Spurge Flax*. The former has yellowish-green flowers, purplish-black fruit, 12 Mm. ( $\frac{1}{2}$ ') long; the latter has whitish flowers, fruit 3 Mm. ( $\frac{1}{8}$ ') long, scarlet. All of these plants bear a striking general appearance in the size of their glossy, shining leaves, flowers, etc., to the extent of suggesting a relationship. The bark should be taken from stem Nov.-Feb., dried, then made into rolls or bundles. Mostly obtained from Ger-

many. In powdering, muzzle the nostrils, or occasionally add a little water, to prevent inhaling poisonous dust.

**CONSTITUENTS.**—Acrid resin, Acrid volatile oil, Daphnin, wax, sugar, yellow coloring matter, malic acid; by dry distillation yields umbelliferon.

**Acrid Resin (Mezerein).**—Obtained by boiling the bark with alcohol, distilling, and treating residue with water, thus leaving resin; it is blackish-green, hard, brittle, permanent, acrid taste; this is the vesicant.

**Daphnin,  $C_{15}H_{16}O_9$ .**—Bitter glucoside; obtained by precipitating the decoction of alcoholic extract with lead subacetate, filtering, decomposing with hydrogen sulphide, evaporating filtrate, treating residue with alcohol or water, crystallizing; soluble in alkalies with yellow color, insoluble in ether, blue with ferric salts, not acrid, with acids forms glucose and daphnetin; little value medicinally, as that resides in the volatile oil and its transformed resin.

FIG. 267.



Mezereum: transverse section, magnified 15 diam.

**PREPARATIONS.**—1. *Fluidextractum Mezerei*. Fluidextract of Mezereum. (Syn., Extractum Mezerei Fluidum, U. S. P. 1890; Fr. Extrait liquide de Mézéréon (de Garou); Ger. Flüssiges Seidelbast-extrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose, mj-10 (.06-.6 Cc.).

**LYTHRACEÆ.**

2. *Fluidextractum Sarsaparillæ Compositum*, 3 p. c.

*Unoff. Preps.*: *Extract* (alcohol), dose, gr. 1–2 (.06–.13 Gm.).  
*Decoction. Ointment.*

The extract and fluidextract are used mostly in liniments.

**PROPERTIES.**—Similar to other drugs with volatile oils, and to sanguinaria: stimulant, diuretic, diaphoretic, alterative, sialagogue, vesicant.

**USES.**—Syphilis, scrofula, rheumatism, skin diseases. Externally—local irritant like cantharides, applied to indolent ulcers to make them again active, also to maintain discharges from setons, fly blisters, etc.

*Poisoning*: Have severe intestinal irritation, vomiting, purging, cold sweats, prostration, collapse, convulsions, death. Evacuate stomach with warm albuminous or mucilaginous drinks, follow with milk, fatty oils, and opium for depression.

*Incompatibles*: Tannin and free acids precipitate the glucoside, and water the resin.

*Synergists*: Alteratives except colchicum.

*Allied Products*:

1. *Daphne salicifolia*.—The leaves, Mexico; used natively as a vesicant.

2. *Fruits* of the various species contain 31 p. c. of fixed oil.

**59. LYTHRACEÆ (PUNICACEÆ). Loosestrife Family.**

Lith-ra'se-e. *L. Lythr-um* + *aceæ*, fr. Gr. *λύθρον*, gore—*i. e.*, from its purple flowers. Herbs, shrubs, often 4-sided; distinguished by containing astringent principle, coloring agent. Leaves exstipulate; calyx tubular, persistent, bearing deciduous petals and stamens; lobes valvate; petals 4–7, wrinkled; stamens 4–14, perigynous, inserted below petals; ovary 1–2–6-celled, superior; ovules many; style 1; stigma rarely 2-lobed; fruit capsule, membranous, dehiscent, surrounded by non-adherent calyx-tube; seeds many, exalbuminous; temperate climates, tropics; astringent, dye.

Genus: 1. *Punica*.

**GRANATUM. POMEGRANATE.**

*Punica*  
*Granatum*, Linné. } The bark of the stem and root.

*Habitat*. S. W. Asia, India, Persia, Arabia, China, Japan, E. (and W.) Indies; naturalized in subtropics, S. United States, etc.; cultivated for fruit, and as an ornament (flowers).

*Syn.* Grenadier, Punic, Puncie or Carthaginian Apple; Br. Granati Cortex; Fr. Écorce de (Granadier) Balaustier; Ger. Cortex Granati, Granatrinde.

**Pu'ni-oa.** *L. puniceus*, of or belonging to Carthage, near which city it is said to have first been found, or fr. *puniceus*, scarlet—*i. e.*, the color of its flowers.

**Gra-na'tum.** *L. granatus*, having many grains or seeds, fr. *granum*—*i. e.*, the many-seeded fruit.

*Pome'gran-ute.* *L. pomum*, a fruit, + *granatus*, grained.



PLANT.—Shrub or small tree, 4.5 M. (15°) high, branches angular, with spiny ends; young shoots and buds red; leaves 2.5–5 Cm.

FIG. 269.

FIG. 268.

*Punica Granatum*: flower.*Punica Granatum*: flowering branch.

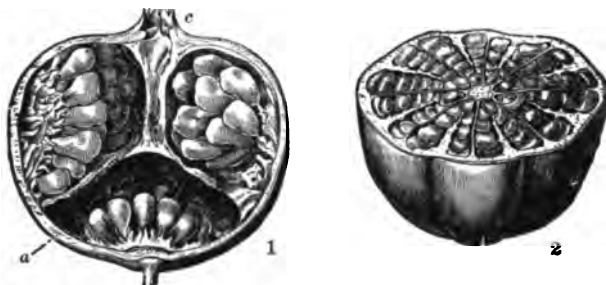
(1–2') long, shining, lanceolate, entire, half evergreen; flowers June–Sept., large; calyx shining, scarlet, tubular, 3 Cm. (1½') long; corolla crimson, 5–7 petals; fruit (balausta), 5–10 Cm. (2–4') broad, resembles an orange, quince, or tomato, 5–8-angled over the dissepiments, short-necked at top. Internally, below the median line, divided by a diaphragm into two stories—upper with 5–9 irregular cells, lower and smaller with 1–3 vertical partitions (cells); seeds angular 12 Mm. (½') long, so numerous that they, with the thin surrounding edible pulp, fill entire fruit. BARK (stem), in single small quills, or transversely curved pieces, 2–10 Cm. (½–4') long, 5–20 Mm. (⅓–⅔') thick, bark, 0.5–3 Mm. (⅓–⅓') thick, yellowish or brownish-gray, with brownish-black fruit-heads of a lichen and small lenticels, inner surface grayish-yellow or brownish, finely striate, fracture short, smooth, phelloderm layer dark green, inner bark dull greenish-yellow; odor distinct; taste astringent, somewhat bitter; (root), dark brown, with some longitudinal patches and scales of cork, green phelloderm layer absent, medullary rays extending nearly to the periderm; powder gray-brown, that of stem greenish tint. *Solvents*: boiling water; diluted alcohol. Dose, 3ss–2 (2–8 Gm.).

*Commercial*.—Root-bark is three times stronger in alkaloids; both rapidly deteriorate with age, the alkaloids undergoing decomposition,

## LYTHRACEÆ.

and that from the white-flowered plant is the richest; it is imported chiefly in the dry state from France and Italy, although we use much of our native product. Besides the bark sometimes are employed domestically the flowers, fruit, rind and acidulous seed-coating; by some the bark from uncultivated plants is preferred.

FIG. 270.



*Punica Granatum*: 1, longitudinal cross-section; 2, transverse cross-section; a, inner rind and ovules; c, the remaining calyx.

**SUBSTITUTIONS.**—1. *Bux'us semper'virens*, *Boxwood Bark*. 2. *Berberis vulgaris*, *Barberry Bark*. Neither contain tannin, hence infusions do not precipitate blue-black with iron like pomegranate bark; they are also very bitter, and the former has a nearly white inner surface. 3. *Granati Fructus Cortex*. This contains tannin 19–28 p. c., extractive 21 p. c., gum 34 p. c., and has the same effect as the bark.

**CONSTITUENTS.**—Tannic acid 20–22 p. c., Alkaloids 1.71 (black-flowered)—2.43 (red-flowered)—3.75 p. c. (white-flowered)—Pelletierine (punicine) 0.5–1.5 p. c., isopelletierine, methylpelletierine, pseudopelletierine (granatonine), mannite (punicin, granatin), gallic acid, sugar, gum, pectin, calcium oxalate, ash 10–17 p. c.

**Tannic Acid**,  $C_{20}H_{16}O_{13}$ .—This is a mixture of gal-  
lotannic acid and punicotannic (granatotannic) acid, the latter insoluble in alcohol, ether, precipitates gelatin, tartar emetic, iron salts, with dilute acids splits into sugar and ellagic acid.

**Pelletierine**,  $C_8H_{15}NO$  (in honor of Pelletier).—This is obtained by mixing bark with milk of lime, displacing with water, exhausting percolate with chloroform. It is regarded by Tanret, its discoverer, to be the anthelmintic constituent, and is a colorless, oily, aromatic alkaloid, resinifying on exposure, soluble in water, alcohol, forms crystalline salts (nitrate, sulphate, tannate, etc.)—considered to be a mixture of the several alkaloids. Dose, gr. 8–24 (.5–1.6 Gm.).

**Pelletierinæ Tannas**, **Pelletierine Tannate**, *official*.—(Syn., Puni-

FIG. 271.



*Granati cortex*: bark of the root.

cine Tannate; Fr. Tannate de Pelletierine; Ger. Pelletierinum tannicum, Gerbsaures (Pelletierin) Punicin.) This is a mixture in varying proportions of the tannates of four alkaloids (punicine, iso-punicine, methyl-punicine, pseudo-punicine), and is obtained by mixing ground bark with milk of lime, percolating with water until exhausted, shaking out percolate with chloroform, and chloroformic solution of free alkaloids with very dilute sulphuric acid; to neutral solution of mixed sulphates add solution tannic acid, whereby tannates are precipitated, dry. It is a light yellow, odorless, amorphous powder, astringent taste, soluble in warm diluted acids, 12.6 parts alcohol, 235 water, 300 ether. *Tests*: 1. Aqueous solutions reduce silver nitrate T. S. (black precipitate), or gold chloride T. S. (thin purplish mirror on test tube) to metallic silver or gold. 2. Sulphuric acid gives yellow color, when heated turns yellow; nitric acid produces no color. Should be kept in small, well-stoppered, dark amber-colored vials. Dose, gr. 4–24 (.26–1.3 Gm.) in  $\mathfrak{z}\text{j}$  (30 Cc.) water.

**PREPARATIONS.**—1. *Fluidextractum Granati*. Fluidextract of Pomegranate. (Syn., Fluidextract of Granatum (Pomegranate-root) Bark; Fr. Extrait liquide d'Écorce de (Granadier) Balaustier; Ger. Flüssiges Granatwurzelnindenextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol 90 Cc. + glycerin 10, finishing with diluted alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{z}\text{ss}$ –1 (2–4 Cc.).

*Unoff. Preps.*: *Decoctum Granati Corticis* (Br.), 20 p. c., dose,  $\mathfrak{z}\text{ss}$ –2 (15–60 Cc.). *Rind*, dose, gr. 15–30 (1–2 Gm.).

**PROPERTIES.**—Anthelmintic, tænifuge, astringent.

**USES.**—The ancients knew its value as a vermifuge (Celsus, Dioscorides, Pliny). In Hindustan, Mohammedan physicians used it in tænia, one of whom in 1804 made this, their secret, public. French physicians prefer the wild-grown plant. Externally and internally astringent; large doses occasion vomiting, purging, cramps, numbness in the legs, giddiness, dim vision, increased urine. The rind is also astringent in diarrhœa, leucorrhœa, hemorrhage, cancerous and other

FIG. 272.



Granati cortex: transverse section, magnified 10 diam.

ulcers of uterus and rectum; intermittent fever. For tape-worm take decoction made by boiling bark  $\mathfrak{z}\text{ij}$  (60 Gm.) + water  $\text{Ojss}$  (.7 L.) down to  $\text{Oj}$  (.5 L.); give this in 3 divided doses at hour intervals in the morning on empty stomach. It is well, a couple of hours after administration, to follow with castor oil  $\mathfrak{z}\text{j}$  (30 Cc.) or compound tincture of jalap  $\mathfrak{z}\text{j}$  (30 Cc.). The worm should be passed sitting in a tepid sitz-bath, thus preventing the expelled portion tearing from

**MYRTACEÆ.**

the head by its weight. It passes usually in a knotted mass. Pomegranate may also be used for tanning, dyeing; the fruit as a refreshing, cooling article of food.

**60. MYRTACEÆ. Myrtle Family.**

Mer-ta'se-e. L. *Myrt-us* + acœ, Gr. *μύρτος*, myrtle, fr. *μύρον*, perfume—i. e., characteristic of some species. Trees, shrubs; distinguished by aromatic, pungent properties (vol. oil); stamens 8–10 +; leaves exstipulate, opposite, dotted with marginal vein; calyx and petals 4–5; ovary inferior, 1–6-celled; fruit dry or succulent; seeds exalbuminous; temperate climates, tropics; aromatic, stimulant, carminative (vol. oil), diaphoretic, antispasmodic, astringent, spices, perfumery, edible fruit; timber.

Genera: 1. *Melaleuca* (Cajuputi). 2. *Eugenia*. 3. *Pimenta* (Myrcia). 4. *Eucalyptus*.

**CAJUPUTUM. CAJUPUT.**

*Oleum Cajuputi.* Oil of Cajuput, *official*.

*Melaleuca Leucadendron*, Linné. } A volatile oil, distilled from the  
(*Cajuputi viridiflora*, (Gærtner) Lyons.) } fresh leaves and twigs.

*Habitat.* E. India islands (Celebes, Bouro, Amboyna, Moluccas, Philippines, Cochin-China).

*Syn.* Kayu-puti, White Wood, *Oleum Cajeputi*; Fr. *Essence* or *Huile de Cajeput*; Ger. *Cajeputöl*.

*Mel-a-leu'ca.* L. fr. Gr. *μέλας*, black + *λευκός*, white,—i. e., bark of the trunk is blackish, that of the branches is whitish.

*Leu-ca-den'dron.* L. fr. Gr. *λευκός*, white, + *δένδρον*, a tree.

*Caj-u-pu'ti.* L. fr. Malay, *kayu*, tree, + *putih*, white—i. e., the appearance of the branches.

*Vir-id-i-flo'ra.* L. *viridis*, green, greenish, + *flos, floris*, flower—i. e., flowers more or less greenish.

**PLANT.**—Small tree, 9–12 M. (30–40°) high; bark gray, brittle, splitting into thin layers; leaves 5–10 Cm. (2–4') long, blade twisted, lanceolate; flowers 5–7.5 Cm. (2–3') long, greenish to whitish, silky, pubescent, spikes; fruit woody, hard, sessile, dehiscing in 3 valves.

**CONSTITUENTS.**—Volatile oil, mucilage, pectin.

**Oleum Cajuputi.** Oil of Cajuput.—A thin, colorless, or greenish (usually due to copper) liquid, peculiar, agreeable, distinctly camphoraceous (cineol) odor, aromatic, bitter taste, sp. gr. 0.925, miscible with alcohol, soluble in 1 part 80 p. c. alcohol, levogyrate; contains at least 55 (50–67) p. c. of cineol (*cajuputol, eucalyptol*),  $C_{10}H_{18}O$ , also the alcohol terpineol,  $C_{10}H_{17}OH$ , several terpenes—*l*-pinene, etc., valericanic and benzoic aldehydes, which upon oxidation impart acid reaction. *Tests*: 1. Oil 5 Cc. + water 5 Cc. + 1 drop diluted hydrochloric acid, shake; a reddish-brown color should not be produced in the acid liquid when separated from the oil, if 1 drop potassium ferrocyanide T. S. be added (abs. of copper). 2. Turns yellowish by ammonia water, purplish-brown by sulphuric acid. *Assay*: For cineol—Dissolve 10 Cc. oil in 50 Cc. purified petroleum benzin, place beaker in

freezing mixture, add phosphoric acid in drops, stirring until white magma of cineol phosphate formed, assumes yellowish or pinkish tint; transfer magma to a force filter, wash with cold purified petroleum benzin, dry, add warm water, which causes cineol to separate; the volume in Cc. of separated oily liquid, multiplied by 10 = volume

FIG. 273.



*Melaleuca Leucadendron* (*Cajuputi viridiflora*)—small branches with leaves, buds, and flowers: 1, vertical section of fruit; 2, transverse section of ovary; 3, vertical section of flower.

p. c. of cineol. It is imported mostly from Celebes (Macassar), Bouro (islands), but some from Singapore, Java, Manila, in empty beer and wine bottles, 25 packed in a crate, or in copper cans. Should be kept cool, in well-stoppered, amber-colored bottles. Dose, Mij-10 (.13-.6 Cc.) in emulsion, pill, or sugar; externally in liniments.

**ADULTERATIONS.**—Copper from the shipping cans, and owing to its cost many cheaper oils are mixed with it, as rosemary, turpentine, camphor, also these sometimes colored with resin of milfoil, all of which render action with iodine more violent.

**PROPERTIES.**—Same as oil of cloves; carminative, stimulant, diaphoretic, vermifuge, parasiticide, rubefacient, counter-irritant.

**USES.**—Rheumatism, myalgia, spasmodic affections of the stomach and bowels, catarrh of bladder, low fevers, gout, colic, cholera morbus, dysmenorrhœa, laryngitis, bronchitis, toothache, chilblains.

**PREPARATION.**—(Unoff.) *Spiritus Cajuputi* (Br.), 10 p. c., dose, Mv-20 (.3-1.3 Cc.).

## CARYOPHYLLUS. CLOVES.

**Eugenia**  
**aromatica**, (Linné) Kuntze. } The dried flower buds.

**Habitat.** Molucca (Spice or Clove) Islands, five in number, N. E. of Celebes, now mostly abandoned there, but cultivated in Indian Ocean islands, Amboyna group, Sumatra, Malacca, Penang, etc., S. America, Brazil, Guiana, Cayenne, Africa, Zanzibar, West Indies.

**Syn.** Mother Cloves, Caryophylli Aromatica; Br. Caryophyllum; Fr. Girofle, Gérofle, Clous (aromatiques) de Girofles; Ger. Caryophylli, Gewürznelken, Nägelein.

**Eu-ge'ni-a.** L. fr. Gr. *eu*, well, + *γενής*, born = noble birth—i. e., in honor of Prince Eugene of Savoy, a great patron of botany (died 1736).

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**Ar-o-mat'i-ca.** *L. aromaticus*, fragrant—*i. e.*, its aromatic, fragrant odor.

**Oar-y-o-phyll'us.** *L. fr.* Gr. *κάρυον*, a nut, + *φύλλον*, a leaf—*i. e.*, referring to the appearance of flower buds.

*Clove.* *L. clavus*, a nail—*i. e.*, the resemblance of its dried flowers.

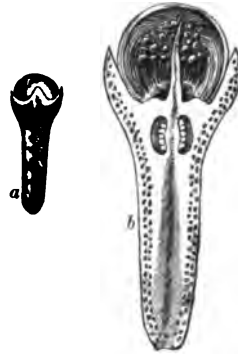
**PLANT.**—Handsome evergreen tree, 9–12 M. (30–40°) high, much branched, forming a pyramidal crown; bark yellowish; leaves 10 Cm. (4') long, 5 Cm. (2') wide, entire, smooth, glandular, parallel veins to midrib, petiolate; flowers 15–20, rose-colored, cymes; fruit berry-like. **FLOWER BUDS** (cloves), about 15 Mm. ( $\frac{3}{5}$ ') long, brownish-black, consisting of a stem-like, solid calyx-tube, obscurely 4-angled and granular roughened, terminated by 4 teeth, and surmounted by a globular head, consisting of 4 petals, which cover numerous curved stamens and 1 style; contain many oil-glands under the epidermis, and when scratched oil exudes; odor strongly aromatic; taste pungent, aromatic, followed by slight numbness; should not float horizontally on water; powder contains few or no starch grains or stone-cells. *Solvents*: alcohol extracts the virtues (volatile oil, resin); water takes up the odor (part of the volatile oil), but none of the pungent taste. *Dose*, gr. 5–10 (.3–.6 Gm.).

**Commercial.**—Trees begin yielding when 6 years old, reaching perfection at 12, thence declining until, at 20, they perish. At first cloves (flowers or buds) are white, then green, pink, and bright red; at the pink stage they are collected by hand-picking on ladders, platforms, or by beating trees with bamboos, and catching falling buds upon outspread cloths; they are now dried by sun or slowly by fire. Each tree yields 5 pounds (2.3 Kg.), which bring on the spot about 10 cents per pound (.5 Kg.). Cloves were unknown to the ancients, being

FIG. 274.

*Eugenia aromaticum.*

FIG. 275.

*Caryophyllus*: a, natural size; b, longitudinal section magnified.

brought to Europe by Arabians and Venetians; the Portuguese and Dutch long monopolized the trade. Most of these now come direct from Zanzibar, although the finest from Penang, some from Pemba.

others via Bombay; however, much of our supply is from W. Indies, Cayenne, Guiana, etc. We have several varieties: 1. *Molucca, Amboyna*; these are the thicker, heavier, darker, most oily and aromatic. In the Moluccas have two annual harvests, June and Dec. 2. *Sumatra, Bencoolen*; these are considered by some of equal high grade as the Molucca. 3. *S. American*; these are usually not so fine as, but fresher than, either of the preceding, yielding in volatile oil 10–15 p. c. Cloves that are light (floating horizontally on water), soft, wrinkled, pale colored, of feeble taste and smell, often without corolla bud or “head,” are inferior from having been treated with a menstruum, or careless picking (including immature green and red buds) and drying, which should be done quickly, avoiding exposure to bad weather—all such should not be used direct or in obtaining oil.

**ADULTERATIONS.**—**FLOWER-BUDS:** Clove-stalks—about 2 Mm. ( $\frac{1}{12}$  inch) thick, brown, contain volatile oil 4–5 p. c., imported for this constituent; mother cloves (clove fruit, anthophylli)—collected just before ripe, 2.5 Cm. (1 inch) long, resemble cloves, but are thicker, lighter, weaker, with 4-lobed calyx, each cell 1–2-seeded, contain volatile oil 2–4 p. c.; exhausted cloves—such as have undergone partial or complete exhaustion and distillation; pimenta—shape and aroma different. All these substances are more frequently ground finely and mixed with powdered cloves, when detection is more difficult, and then only by the presence of their peculiar starch grains, and the weakness of the preparations, which give unsatisfactory results in use. **OIL:** That from which eugenol has been abstracted, or foreign eugenol added; clove-stem oil, alcohol, oils of turpentine, cinnamon, pimenta and copaiba, petroleum, fixed oils, phenol.

**CONSTITUENTS.**—Volatile oil 18 p. c., tannin (gallo-tannic acid) 10–13 p. c., gum 13 p. c., resin (tasteless) 6 p. c., caryophyllin, eugenol,  $C_{10}H_{12}O_2$ , vanillin, green wax, cellulose 28 p. c., water 18 p. c.

**Oleum Caryophylli.** Oil of Cloves, *official*.—(Syn., Fr. Essence de Girofles; Ger. Eugenol, Nelkenöl.) This volatile oil is distilled from cloves with water or steam, and usually sodium chloride (3 p. c.) is added to raise the ebullition-point, possibly to 109.5° C. (229° F.). It is a colorless or pale yellow, thin liquid, darker and thicker by age, strongly aromatic odor of cloves, pungent, spicy taste, sp. gr. 1.060, soluble in equal volume alcohol, 2 volumes 70 p. c. alcohol, gives semi-solid yellowish mass when shaken with solution potassium hydroxide or ammonia water; contains (1) light portion—sesquiterpene, caryophyllene,  $C_{15}H_{24}$  (polymeric with terpene,  $C_{10}H_{16}$ ), sp. gr. 0.918, (2) heavy portion—phenol, eugenol,  $C_{10}H_{12}O_2$ , at least 80 (80–90) p. c., also its acetic and acetyl-salicylic acid ester, methyl-amyketone (gives odor), vanillin, furfural (causes oil to darken), and methyl alcohol. **Tests:** 1. Dissolve oil 2 drops in 4 Cc. alcohol, + 1 drop ferric chloride T. S. get bright green; or add 1 drop diluted ferric chloride T. S. (1 in 4) get blue color, changing to yellow. 2. Shake 1 Cc. oil with hot water 20, mixture should scarcely be acid, cool, clear filtrate + 1 drop ferric chloride T. S. should give transient grayish-green, but not

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blue or violet (abs. of phenols). *Assay*: For eugenol—Shake 5 minutes in a long-necked flask (graduated in tenths) 10 Cc. oil with 100 potassium hydroxide T. S.; when liquids completely separated add sufficient potassium hydroxide T. S. to raise the lower limit of oily layer to zero-mark of scale, note volume of residual liquid, which should not be more than 2 Cc., indicating at least 80 p. c. of eugenol. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{m}\bar{\text{j}}-5$  (.06–.3 Cc.).

**Eugenol.**  $\text{C}_{10}\text{H}_{12}\text{O}_2$ , *official*.—(Syn., Eugenolum, Eugenin, Caryophyllic Acid, Eugenic Acid, Allylguaiacol, Ethylmethyl-pyrocatechol, Para-oxy-metamethoxyallyl benzol.) This unsaturated, aromatic phenol is obtained by shaking oil of cloves with excess of 5–10 p. c. solution sodium hydroxide in a separator, drawing off resulting solution of eugenol sodium; wash aqueous liquid with ether, decompose with diluted sulphuric acid, wash separated eugenol with solution sodium carbonate (to remove adhering acid), distil with steam or in vacuo. It is a colorless or pale yellow, thin liquid, odor of cloves, pungent spicy taste, darker and thicker by age, sp. gr. 1.074, miscible with alcohol, soluble in two parts 70 p. c. alcohol, also in ether, chloroform, glacial acetic acid, with bases yields crystallizable salts, boils at  $254^\circ\text{C}$ . ( $489^\circ\text{F}$ .), fused with potassium hydroxide decomposes into protocatechuic and acetic acids. *Tests*: 1. 5 Cc. of mixture, 1 part + 20 hot water, (reddens litmus paper) + 1 drop ferric chloride T. S. gives transient grayish-green color, not a blue or violet (abs. of phenol). 2. 5 Gm. shaken with 20 Gm. 15 p. c. solution sodium hydroxide + 6 Gm. benzoyl chloride, forms benzoyl-eugenol,  $\text{C}_{10}\text{H}_{11}(\text{C}_6\text{H}_5\text{O})_2$ , which being insoluble in water is washed with it and recrystallized from alcohol. 3. When oxidized with potassium permanganate yields vanillin. Upon eugenol alone the value of oil of cloves depends.

**Caryophyllin**,  $\text{C}_{10}\text{H}_{16}\text{O}$ .—Obtained by treating ethereal extract of cloves with water, the resulting precipitate is filtered and treated with ammonia to purify; occurs in tasteless, inodorous silky needles, soluble in ether, slowly in alcohol, colored red with sulphuric acid, and by oxidation with nitric acid yields crystals of caryophyllinic acid,  $\text{C}_{20}\text{H}_{32}\text{O}_6$ .

**PREPARATIONS.**—1. *Tinctura Lavandulæ Composita*,  $\frac{1}{2}$  p. c. 2. *Tinctura Rhei Aromatica*, 4 p. c. 3. *Vinum Opii*, 1 p. c.

*Unoff. Preps.*: *Infusum Caryophylli* (Br.), 2.5 p. c., dose,  $\bar{\text{z}}\text{ss}-1$  (15–30 Cc.). *Tincture*, 25 p. c. (Fr. alcoholic), dose,  $\bar{\text{z}}\text{ss}-1$  (2–4 Cc.).

**PROPERTIES.**—Stimulant, stomachic, carminative, antiemetic, aromatic, antispasmodic, rubefacient, germicide, antiseptic. Increases circulation, temperature, digestion, nutrition; excreted by kidneys, skin, liver, bronchial mucous membrane, stimulating and disinfecting these emunctories.

**USES.**—Nausea, vomiting, flatulence, colic, indigestion, condiment, corrective; externally in rheumatism, neuralgia, toothache (oil + oil of peppermint + hydrated chloral), in liniments, etc.

*Allied Plant*:

1. *Eugenia Jambola'na*, *Jambul*, *Java Plum*.—E. Indies. Large



tree producing edible fruit; all parts astringent, but seed and bark also arrest formation of sugar in diabetes; seed 1.2 Cm. ( $\frac{1}{2}$ ') long, a third as thick, oval, one end truncated, blackish-gray, hard, heavy, little odor and taste; capsules, fluidextract. Dose, gr. 5–10 (.3–.6 Gm.).

## PIMENTA. PIMENTA.

**Pimenta officinalis**, *Lindlay*.  
**(Pimenta Pimenta**, (*Linné*) *Lyons*.) } The dried, nearly ripe fruit.

*Habitat.* C. and S. America, W. Indies, Jamaica, Venezuela; cultivated.

*Syn.* Allspice, Pimento or Clove (Jamaica) Pepper, Semen or Fructus Amoni, Piper Jamaicense; Fr. Piment de la Jamaïque, Toute épice; Ger. Nelkenpfeffer, Englisches Gewürz, Neugewürz.

**Pi-men'ta.** L. fr. *Sp. pimenta*, pepper—i. e., first European name for *Allspice*; L. *pigmentum*, spice.

**Of-fi-ci-na'lis.** L. see etymology of (*Asagraea*) *officinalis*, page 101.

*All'spice* = *all* + *spice*—i. e., supposed to combine cinnamon, nutmeg, and clove odor—at one time all the important spices.

**PLANT.**—Handsome evergreen tree 9–12 M. (30–40°) high, slender trunk, bark smooth, gray; young branches quadrangular; leaves 10–15 Cm. (4–6') long, bright green, entire, oval-oblong, obtuse, pellucid-punctate beneath, midrib prominent; flowers small, white, racemes. **FRUIT**, 5–7 Mm. ( $\frac{1}{2}$ – $\frac{1}{4}$ ') thick, subglobular, crowned with

FIG. 276.



*Pimenta officinalis* (Pimenta).

short, 4-parted calyx and short style, or their remnants, dark brown, pericarp brittle, 1 Mm. ( $\frac{1}{15}$ ') thick, glandular-punctate, 2-celled, each cell 1-seeded; seed reddish-brown, plano-convex, slightly reniform; odor and taste peculiarly, agreeably aromatic; pericarp and embryo contain oil-cells, the embryo also starch grains. *Solvents*: alcohol extracts the virtues; water absorbs the flavor, and if hot, some constituents. Dose, gr. 5–30 (.3–2 Gm.).

**Commercial.**—Forests are cleared of all other trees, leaving only the allspice, which bear when 3–4 years old. The fruit (drupe) if allowed to ripen fully becomes purplish-black, fleshy, sweet, and devoid of aromatic properties, consequently it is collected when full-grown, yet green—the small twigs bearing the bunches or clusters being broken off and dried

in ovens (kiln-dried allspice), or in the sun 10–12 days, which, in spite of yielding a better product, is attended with risk, since they must be housed at night and at other times protected from damp and rainy

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weather ; occasionally fruit is colored with ferric oxide or mixed with that of the spice bush.

**CONSTITUENTS.**—Volatile oil 3–4 p. c., resin, fixed oil 6–8 p. c., tannin, sugar, gum, ash 4 p. c.

**Oleum Pimentæ.** Oil of Pimenta, *official.*—(Syn., Oil of Allspice ; Fr. Essence de Piment de la Jamaïque ; Ger. Pimentöl, Nelkenpfefferöl.) This volatile oil, obtained by distilling pimenta with water or steam, comes over in two fractions, one light, the other heavy, but both mixed together. It is a colorless or reddish-yellow liquid, strong, aromatic odor of allspice, pungent, spicy taste, darker and thicker by age, sp. gr. 1.045, soluble (clear) in 90 p. c. alcohol, in 2 volumes 70 p. c. alcohol ; contains at least 65 p. c., by volume, of eugenol,  $C_{10}H_{12}O_2$ , probably a sesquiterpene. *Tests*: 1. Shake with hot water, cool, filter, + 1 drop ferric chloride T. S. should give grayish-green, not blue or violet color (abs. of phenol). 2. Sulphuric acid gives red, then purple ; mixed with equal volume concentrated solution sodium hydroxide forms semi-solid mass. *Assay*: For eugenol—Oil 10 Cc. + 100 Cc. potassium hydroxide T. S., shake in flask with long neck (graduated in tenths) ; when liquids separate add sufficient potassium hydroxide T. S. to raise the lower limit of oily layer to zero ; note volume of residual liquid, which should not be more than 3.5 Cc., indicating 65 p. c. of eugenol. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{m}\text{j}$ –5 (.06–.3 Cc.).

**PREPARATIONS.**—(Unoff.) *Aqua Pimentæ* (Br.), 25 Gm. + water 1,000 Cc., distil 500 Cc. *Infusion*, 5 p. c., dose,  $\mathfrak{z}\text{j}$ –2 (30–60 Cc.).

**PROPERTIES.**—Similar to cloves ; stomachic, stimulant, carminative, condiment, improves digestion, increases salivary secretion.

**USES.**—Flatulence, nausea, intestinal colic, corrective to griping purgatives and nauseous tasted medicines. May combine with Burgundy pitch or lead plaster for rheumatism. neuralgia, chilblains, etc., causing local warmth, smarting, redness.

*Allied Plant*:

1. *Myrcia* (*Pimenta*) *ac'ris*, *Bayberry*.—The volatile oil, official 1880–1900 ; W. Indies, Jamaica ; cultivated. Tree beautiful, fragrant, 9–12 M. (30–40°) high, leaves 5–8 Cm. (2–3') long, ovate, coriaceous, pellucid-punctate, exhaling aroma when bruised similar to cloves (volatile oil), flowers small, white with red tinge, fruit globular berry, size of a pea, blackish, resembling allspice ; contains (leaves) volatile oil, tannin. Oil obtained by distilling leaves with water or steam ; it is an aromatic (clove-like), yellowish, pungent liquid, containing eugenol, chavicol, myrcene, phellandrene, citral, etc. Astringent, tonic, stimulant, perfume ; nervous headache, faintness, chafing, hair-washes, perfumery ; spirit (*spiritus myrciæ*, bay rum) may be made by mixing oil of myrcia 8 Cc., oil of orange peel .5, oil of pimenta .5, alcohol 610, water q. s. 1,000 Cc., or better grades by distilling leaves with St. Croix rum.

## EUCALYPTUS. EUCALYPTUS.

**Eucalyptus globulus**, Labillardière. } The dried leaves, collected from older parts of the tree.

*Habitat.* Australia (Tasmania, Victoria); cultivated in subtropics, Europe, N. Africa, S. United States (California, Florida, etc.); rich valleys, moist slopes of wooded hills.

*Syn.* Gum Wood, Fever Tree of Australia, Blue-gum Tree, Woolly Butt, or Iron Bark Tree; Fr. Feuilles d'Eucalyptus; Ger. Eucalyptus-Blätter.

**Eu-ca-lyp'tus.** L. fr. Gr. *eu*, well, good, *καλυπτός*, covered—i. e., the calyx-limb covers the flower bud before expansion and afterward, at anthesis, falls off in the shape of a lid or cover—the outer operculum of the bud (not the inner of united petals).

**Glob'u-lus.** L. *globulus*, *globulosus*, a little ball, globular—i. e., the thick button-like form of the fruit.

**PLANT.**—Rapid-growing tree, 60–90 M. (200–300°) high, 3–6 M. (10–20°) thick (the largest being 141 M. (470°) high, 27 M. (87°) in circumference, from *E. amygdalina*); bark ash-colored; flowers Nov.–Dec., hermaphrodite, pedunculate, whitish, buds very glaucous, and consist of calyx-tube covered by conical lid (operculum) of calyx-limb and united petals; fruit capsules 18 Mm. ( $\frac{3}{4}$ ') wide, half-globular, 4–5-ribbed, dehiscing at apex, many-seeded. **LEAVES**, petiole twisted, 2–3 Cm. ( $\frac{4}{5}$ – $1\frac{1}{5}$ ') long, blade lanceolately scythe-shaped, 15–30 Cm. (6–12') long, 2–4 Cm. ( $\frac{4}{5}$ – $1\frac{3}{5}$ ') broad, tapering above, rounded or abruptly contracted at the oblique base, coriaceous, pale green, pellucid-punctate, entire, venation inconspicuous, anastomosing near margin, stomata deeply depressed (level or elevated in spurious leaves); odor aromatic, somewhat camphoraceous; taste aromatic, bitter, cooling; powder should not reveal guard-cells of stomata or wavy epidermal cells upon vertical view. *Solvents*: boiling water; diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

**Commercial.**—The blue-gum tree of Tasmania (exudes a blue-gum) was discovered by Labillardière, French botanist, in 1792, and introduced into Europe 1856. It is sensitive to cold, but under favorable conditions attains the height of 15 M. (50°) in 6 years; the wood is durable, hard, resinous; there are 135 species. The aborigines knew something of its virtues, the Spaniards in 1867 used it for fever and ague, but Drs. Brunel and Ramel, 1868–1869, extolled and proved its antiperiodic properties. Leaves are picked, carefully dried, and enter trade very little broken; those that are ovate, equilateral, rather thin should be rejected, and only the Australian variety used, as they vary less in yield of oil; however, most of our supply comes from California.

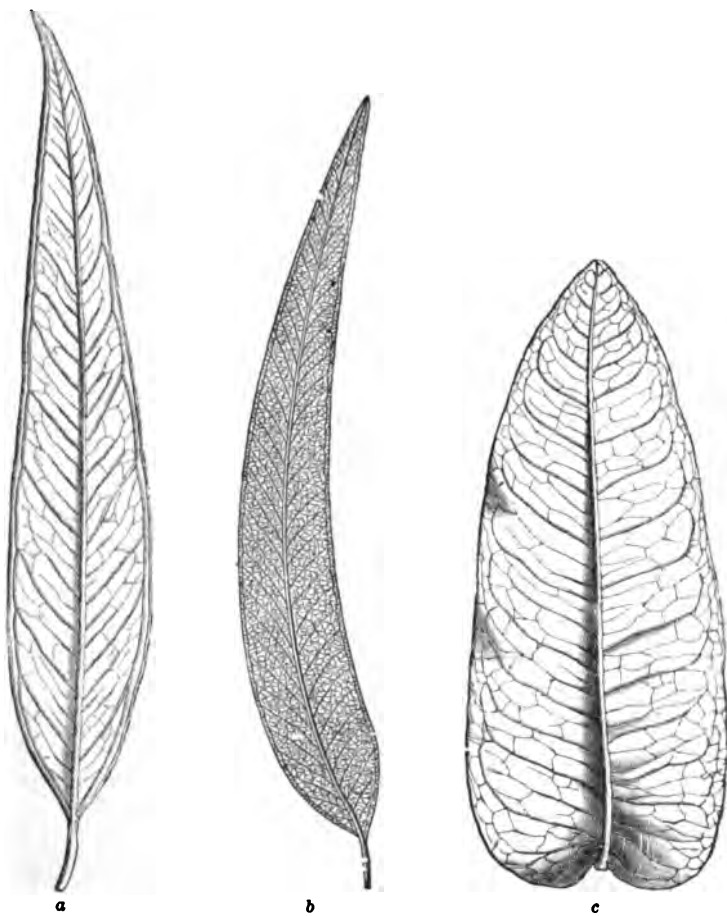
**CONSTITUENTS.**—Volatile oil 6 p. c., tannin, cerylic alcohol, 3 resins (1 acid, crystallizable), eucalyptic acid.

**Oleum Eucalypti.** Oil of Eucalyptus, *official.*—(Syn., Fr. Essence d'Eucalyptus; Ger. Eucalyptusöl.) This volatile oil is distilled from fresh leaves (as old leaves contain very little oil) of this and other species of *Eucalyptus*, and rectified by steam distillation. It is a

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colorless or pale yellow liquid, characteristic, aromatic, camphoraceous odor, pungent, spicy, cooling taste, sp. gr. 0.920 ; soluble in alcohol, 3 volumes 70 p. c. alcohol, dextrogyrate ; contains at least 50 p. c., by volume, of cineol (eucalyptol),  $C_{10}H_{18}O$ , cymene,  $C_{10}H_{14}$ , 20 p. c., eucalyptene,  $C_{10}H_{18}$ , terpene—dextrogyrate pinene (small amount),  $C_{10}H_{16}$ , also a little valeric, butyric, and capronic aldehydes. With hydrochloric acid yields eucalypteol (eucalyptene hydrochloride),  $C_{10}H_{16} \cdot 2HCl$ , in

FIG. 277.

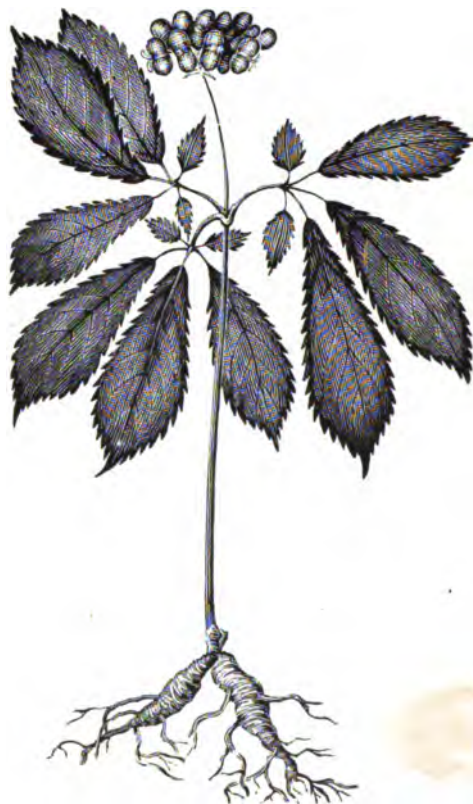


*Eucalyptus globulus*: a, b, leaves from old twig; c, from young twig.

white hygroscopic, aromatic crystals ; with phosphoric oxide yields eucalyptolene, thickish liquid. *Test*: 1. Mix 2 Cc. with glacial acetic acid 4 Cc. + 3 Cc. saturated aqueous solution sodium nitrite ; should not when stirred form crystals of phellandrene nitrite (abs. of eucalyptus oils containing much phellandrene). *Assay*: For cineol—10 Cc. oil + 50 Cc. purified petroleum benzin—immerse container in

freezing mixture, add phosphoric acid in drops, constantly stirring until white magma of cineol phosphate formed, turns yellowish or pinkish; transfer magma to force filter, wash it with cold purified petroleum benzin, dry by pressure between two porous plates; transfer precipitate (cineol phosphate) to narrow graduated cylinder, add warm water to separate the cineol; the volume in Cc. of separated oil, multiplied by 10, represents volume p. c. of cineol (eucalyptol). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $m_v-15$  (.3-1 Cc.).

FIG. 278.

*Panax (Aralia) quinquefolium.*

**Eucalyptol.** Eucalyptol,  $C_{10}H_{18}O$ , *official*.—(Syn., Cineol, Cajuputol; Ger. Eucalyptus Kampfer.) This organic oxide is the most valuable constituent of eucalyptus oil; it is a neutral substance having a definite chemical composition (which is not true of the oil), and is obtained by distilling the volatile oil (of this and other species) and placing in a freezing mixture that portion which comes over between  $150-175^{\circ} C.$  ( $302-347^{\circ} F.$ ), when it crystallizes in long, colorless needles. Also may get it by distilling the leaves and setting aside (as

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crude eucalyptol) that portion coming over between 170–178° C. (338–352° F.), which to obtain pure has to be redistilled with potassium hydroxide or calcium chloride; other plants yield it, as *santonica*, *rosemary*, *curcuma*, *cajuput*, *mentha*, *salvia*, *laurus*, *canella*, etc.; with phosphoric anhydride (oxide) get eucalyptene and eucalyptolene. It is a colorless liquid, characteristic, aromatic, camphoraceous odor, pungent, spicy, cooling taste, sp. gr. 0.925, boils at 176° C. (349° F.), freezes at –2° C. (28° F.), liquefying again at –1° C. (30° F.). *Tests*: 1. Optically inactive (abs. of oil of eucalyptus and other volatile oils). 2. Alcoholic solution + 1 drop ferric chloride T. S. should not give brown or violet color (abs. of phenols). Dose, ℥v–15 (.3–1 Cc.).

**PREPARATIONS.**—I. **LEAVES**: 1. *Fluidextractum Eucalypti*. Fluid-extract of Eucalyptus. (Syn., *Extractum Eucalypti Fluidum*, U. S. P. 1890; Fr. *Extrait liquide d'Eucalyptus*; Ger. *Flüssiges Eucalyptus-extrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv–60 (1–4 Cc.).

II. **EUCALYPTOL**: 1. *Liquor Antisepticus*,  $\frac{1}{4}$  p. c.

*Unoff. Preps.*: **LEAVES**: *Tincture*, 15 p. c., dose, ʒss–2 (2–8 Cc.). *Infusion*, dose, ʒj–2 (30–60 Cc.). *Extract*, dose, gr. 2–10 (.13–.6 Gm.). **OIL**: *Unguentum Eucalypti* (Br.), 10 p. c. *Water (Aqua)*, dose, ʒj–4 (4–15 Cc.).

**PROPERTIES.**—Antiperiodic, antipyretic, expectorant, stimulant, astringent, antiseptic, disinfectant, diaphoretic; like quinine arrests white blood-corpuscle movement; increases flow of saliva, gastric juice, heart action, appetite, digestion. Large doses produce indigestion, diarrhoea, vomiting, muscular weakness, low temperature, renal and cerebral congestion, paralyzed respiration, death. Destroys low forms of life, reduces arterial tension and enlarged spleen. It antagonizes malaria thus: 1, its dead leaves elevate the low moist soil; 2, being a rapid grower, its leaves, roots, etc., absorb much malarial soil-water and noxious germs, thus causing the surrounding country to become dry, thereby purifying the atmosphere; 3, its enormous foliage protects large areas from direct sun-rays which favor the generation of animalculæ; 4, its aseptic emanations purify the air. Owing to these properties it is cultivated largely in malarial districts, to render them sanitative, and to reclaim infected localities, as portions of Australia, Jamaica, Roman Campagna, etc. It is eliminated by skin, bronchia, kidneys, lungs, with more or less irritation, imparting odor to breath and urine.

**USES.**—Intermittent fever, genito-urinary and pulmonary catarrh, chronic bronchitis, mucous membrane affections, asthma (smoked with stramonium). Used when quinine is contra-indicated, intermittents, typhoid, scarlatina, whooping-cough, cancer, hemorrhages. Externally—as antiseptic in ulcers, gonorrhoea, spongy gums, gleet, deodorizer in diseases with disagreeable odor, preventive of putrefaction; spray beneficial in diphtheria, gangrene of lungs, fetid bronchitis. Tincture

(1 part) added to cod-liver oil (100 parts) removes fishy flavor; the leaves deter moths entering woolen cloth; bark used for tanning, dyeing.

*Incompatibles*: Agents promoting waste, alkalies, mineral acids and salts.

*Synergists*: Aromatic bitters, antispasmodics, copaiba, cubeb, turpentine, etc.

*Allied Plants*:

1. *Eucalyptus amygdali'na*, *Peppermint Tree*.—Australia; has peppermint odor, and being more accessible, its foliage is much used for obtaining *eucalyptus kino*, and volatile oil, which oil is claimed to be almost entirely without eucalyptol.

2. *E. dumo'sa*, 3. *E. obli'qua* (Stringy-bark tree), 4. *E. Leucox'ylon* (*siderox'ylon*) (Iron-bark tree), and 5. *E. oleo'sa* (Mallee tree).—The yield of these in volatile oil is varying, but Bosisto obtained the following results, which are only of comparative interest, thus for every 100 pounds (45.5 Kg.) of each variety: No. 1 gave 50 ounces (1.5 L.); No. 2, 30 ounces (.9 L.); No. 3, 8 ounces (.2 L.); No. 4, 16 ounces (.5 L.); No. 5, 20 ounces (.6 L.), while the official yielded 12 ounces (.3 L.).

6. *Ara'lia spino'sa*, *Hercules' Club*, *Prickly Elder*.—*Araliaceæ*. The bark, official 1820–1880. N. America. Prickly tree, 3–9 M. (10–30°) high, leaflets crowded at summit; flowers white; bark in quills, curves, gray, prickly, inside yellowish, aromatic, acrid; contains araliin, volatile oil, resin. Used as stimulant, diaphoretic, demulcent (emetic, cathartic), for rheumatism, skin eruptions, syphilis, colic, dyspepsia, toothache, vomiting, nervousness; externally antidote to rattlesnake-bites; in infusion, decoction, tincture, masticatory. Dose, gr. 30–60 (2–4 Gm.).

7. *A. nudica'u'lis*, *Wild, Virginian*, or *False Sarsaparilla*.—The root (rhizome), official 1820–1880. N. America. Small shrub, stem scarcely above ground, leaf single, petiole .3 M. (1°) high; leaflets ovate, serrate, flowers greenish. Root .3 M. (1°) long, 5 Mm. ( $\frac{1}{8}$ ') thick, annulate, brownish-gray, inside whitish, spongy pith, aromatic odor and taste; contains volatile oil, resin, starch. Used as stimulant, diaphoretic, alterative—like sarsaparilla, in infusion, decoction. Dose, gr. 30–60 (2–4 Gm.).

8. *Pa'nax quinquefo'lium* (*Aralia quinquefolia*), *Panax*, *Ginseng*.—The root, official 1840–1880. N. America. Small shrub, .3 M. (1°) high, smooth, leaflets 5's, serrate; flowers yellowish, fruit scarlet; root 5–12.5 Cm. (2–5') long, fusiform, annulate, branched, brownish-yellow, wood yellowish, sweetish, aromatic; contains panaxin, resin, volatile oil, starch, gum. Used as stimulant, demulcent, stomachic, in infusion, decoction, tincture. The *Chinese Ginseng* (*Aralia Gin'seng*) is very similar to this, slightly larger. Used natively as nervine, aphrodisiac. Dose, 3ss–2 (2–8 Gm.).

## UMBELLIFERÆ.

## 61. UMBELLIFERÆ. Parsley (Carrot) Family.

Um-bel-lif'e-re. L. *Umbellifer-æ*—*umbella*, umbel, + *ferre*, to bear—i. e., flowers borne in umbels. Herbs, shrubs. Distinguished by possessing aromatic, stimulant, volatile oils; flowers in umbels; stems hollow; leaves usually compound; fruit cremocarp, with oil-tubes (*vittæ*), indehiscent; calyx adnate to ovary; petals and stamens 5, inserted on fleshy epigynous disk; ovary 2-celled, inferior; seeds 1 in each carpel, albumin horny; temperate climates; aromatic, carminative, stimulant, tonic (vol. oil), narcotic, poisonous (acid juice), antispasmodic (gumresin).

Genera: 1. *Fœniculum*. 2. *Pimpinella*. 3. *Carum*. 4. *Coriandrum*. 5. *Conium*. 6. *Ferula*.

## FÆNICULUM. FENNEL.

*Fœniculum* }  
*vulgare*, Miller. } The dried, nearly ripe fruit.

*Habitat.* S. Europe, W. Asia; cultivated.

*Syn.* Large, Sweet or Wild Fennel, Fennel Seed or Fruit, Semen Fœniculi; Br. Fœniculi Fructus; Fr. Fenouil, Fruits (Semences) de Fenouil; Ger. Fenchel (semen, fructus).

*Fœ-ni-c'u-lum.* L. fennel, dim. of *fenum* or *fernum*, hay—i. e., from a resemblance in odor.

*Vul-ga're.* L. *vulgaris*, common, ordinary—i. e., kind growing wild, and in general use, originally not cultivated.

**PLANT.**—Large, perennial (biennial, annual) herb; stem .6–1.2 M. (2–4°) high, furrowed, green, glaucous, branched; rootstock thick; leaves twice pinnate, pinnæ very narrow, often only as wide as the thin petiole; flowers yellow, 15–20 in umbels, all parts with agreeable aromatic odor; sweet, aromatic taste. **FRUIT**, cremocarp, oblong, nearly cylindrical, mericarps usually separated, each 4–10 Mm. ( $\frac{1}{8}$ – $\frac{2}{3}$ ') long, 2–3 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ') broad, more or less curved, with 5 prominent light-colored primary ribs, otherwise smooth, yellowish or brownish-green; pericarp containing 1 oil-tube between each two ribs, and 2 upon the flat side; odor and taste aromatic, anise-like. *Solvents*: alcohol (hot water partially) extracts the virtues, depending upon volatile oil. Dose, gr. 10–30 (.6–2 Gm.).

**Commercial.**—Fennel is a very variable plant as to size, habit, shape, number of rays in umbels, and shape of fruit. This results from the fact that the wild *F. vulgare* has been under cultivation for centuries,

FIG. 279.



*Fœniculum vulgare*: a, cross-section of fruit; b, flower with stamens.



consequently the natural outgrowth has been several well-marked new species. The fruit is cultivated largely in Germany, France, and Russia, the chief sources of supply, but plant flourished well in all except cold climates. The German, French, and Indian fennels con-

FIG. 280.



*Foeniculum* fruit: 3 diam; transverse section, 8 diam.

form to above dimensions, the Russian and Japanese only half as large; the Saxon is largest and usually preferred; the bitter, mostly from French wild plants, is smallest. The Japanese is slightly larger than anise, and possesses similar odor; the Roman is sweetish, greenish, very large, preferred to *F. dulce*, or by some considered a distinct species, *F. sativum*, but by continued cultivation reverts to original wild form, therefore cannot properly be considered a new species. The most important commercial varieties are: 1. German; 2. Russian; 3. Saxon; 4. Roman;

all sometimes sold as *longs* and *shorts*, the former having preference. We are largely supplied from our own country; the root is used in medicine, but with less satisfaction; in Italy grown not only for the fruit, but the young shoots for eating purposes.

**CONSTITUENTS.**—Volatile oil 2–6 p. c., fixed oil 12 p. c., (sugar, mucilage, ash 8–12 p. c.).

**Oleum Fœniculi.** Oil of Fennel, *official*.—(Syn., Fr. *Essence de Fenouil*; Ger. *Fenchelöl*.) This volatile oil, obtained by distilling fruit (or entire plant) with water or steam, is a pale yellowish liquid, chemically almost identical with anise oil, but has characteristic aromatic odor of fennel, sweetish, mild, spicy taste, sp. gr. 0.965, soluble

FIG. 281.



*Daucus Carota*: magnified 5 diam.

in equal volume alcohol, 10 volumes or less 80 p. c. alcohol, congeals at 5° C. (41° F.); contains (about the same as oil of anise) pinene, phellandrene,  $C_{10}H_{16}$  (substance isomeric with oil of turpentine), dipentene (sometimes limonene), fenchone (a bitter camphor),  $C_{10}H_{16}O$ , anethol,  $C_{10}H_{12}O$ , 60 p. c., also its isomer chavicol, anise ketone, anisic aldehyde, anisic acid. Anethol gives largely the value, and crystallizes out in the cold; it consists of two portions, one liquid—an eleopten, another solid—a stea-

arocten, and the percentages of these two are not always uniform, some specimens of oil having more of the solid, while others (best) more of the liquid anethol. This oil from different sources is usually without some of these (either phellandrene, fenchone, or anethol), thus phellandrene occurs in the wild bitter, limonene in the Macedonian, pinene and dipentene in the Saxon; fenchone in the Saxon, Galician, Moravian, Roumanian and Japanese, but not in the Roman and Macedonian; anethol is usually absent in the wild bitter. It should be kept cool, in well-stoppered, amber-colored bottles, and when partly or wholly solidified, should be liquefied by

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warming before being dispensed. *Tests*: 1. Alcoholic solution should be neutral, and not colored blue or dark by 1 drop ferric chloride T. S. (abs. of volatile oils containing phenols). 2. When dropped into water and not shaken should produce no milkiness (abs. of alcohol); congealing point should not be below 5° C. (41° F.). Dose, ℥ij–5 (.13–.3 Cc.).

PREPARATIONS.—I. FRUIT: 1. *Infusum Sennæ Compositum*, 2 p. c.

II. OIL: 1. *Aqua Fœniculi*. Fennel Water. (Syn., Fr. Eau de Fenouil; Ger. Fenchelwasser.)

*Manufacture*:  $\frac{1}{2}$  p. c. Triturate oil .2 Cc. with purified talc 1.5 Gm., adding distilled water gradually q. s. 100 Cc., filter until clear. Dose, ʒij–8 (8–30 Cc.).

2. *Pulvis Glycyrrhizæ Compositus*,  $\frac{2}{5}$  p. c. 3. *Spiritus Juniperi Compositus*,  $\frac{1}{10}$  p. c.

*Unoff. Preps.*: I. FRUIT: *Fluidextract*, dose, ℥x–30 (.6–2 Cc.). *Syrup. Infusion*, 5 p. c., dose, ʒj–16 (4–60 Cc.).

FIG. 282.



Angelica—flowering stem and cross-section of cremocarp: a, the seed; f, the 2-ribbed wings (mericarps).

PROPERTIES.—Carminative, stimulant, stomachic, galactagogue; employed by the ancients very similarly.

USES.—Nausea, colic, amenorrhœa, infantile flatulency. It increases the secretion of milk, perspiration, mucus, urine. As a corrective to griping medicines, senna, rhubarb, etc. Much used in cattle medicines; the oil in cordials, elixirs.

*Allied Plants*:

1. *Daucus Caro'ta*, Carrot (*Seed*).—The fruit, official 1820–1880. N. Asia, Europe; biennial herb, .6–1 M. (2–3°) high, hispid; flowers July–Sept., white; root fleshy, fusiform, aromatic, edible; fruit 4 Mm. ( $\frac{1}{8}$ ') long, oval, flat, grayish-brown, each mericarp with 9 ribs, 6 oil-tubes; odor aromatic; taste pungent; contains volatile oil, fixed oil. Used as a stimulant, diuretic, excitant, for dropsy, strangury, nephritic affections, amenorrhœa, ulcers, eczema, itching; in infusion, fluidextract. Dose, gr. 10–30 (.6–2 Gm.).

2. *Angelica Archangelica* (*officinalis*), *European Angelica*.—The root, official 1860–1870, and *Angelica atropurpurea*, *American (Purple-stemmed) Angelica*. The root, official 1820–1860. Herbs, 1.8–2 M. (5–6°) high; stems purplish, smooth, hollow, jointed; leaves double pinnate; flowers greenish-white; roots 5–10 Cm. (2–4') long, 2.5–5 Cm. (1–2') thick, annulate, fusiform, juicy, aromatic, sweetish, pungent, bitter; contains volatile oil, resin, valerianic acid. Used as tonic, stimulant, carminative, diaphoretic, emetic, for typhoid condition, bronchitis, intermittents, rheumatism, gout, painful and swollen parts, condiment; in infusion, tincture, fresh juice (poisonous). Dose, gr. 10–30 (.6–2 Gm.).

3. *Heracleum lanatum*, *Cow-parsnip*, *Masterwort*.—The root, official 1820–1860, United States. Plant 1.5–3 M. (5–10°) high, 2.5–4 Cm. (1–1½') thick, pubescent, hollow; root resembles parsley, disagreeable odor, acrid taste, fruit has each mericarp with 5 ribs and 6 oil-tubes; contains volatile oil, resin. Used as stimulant, carminative, for epilepsy, dyspepsia, warts, escharotic; in infusion, juice. Dose, 3ss–1 (2–4 Gm.).

4. *Eryngium aquaticum* (*yuccaefolium*), *Button Snakeroot*.—The root, official 1820–1860. United States. Plant .6–1.8 M. (2–6°) high, leaves rigid, pointed, .3–1 M. (1–3°) long, bristly; flowers white; root tuberous, 6–12 Mm. (¼–½') long, branched, cup-shaped scars, central pith, aromatic; taste sweet, acrid, aromatic, resembles parsnip; contains volatile oil. Used as diaphoretic, expectorant, sialagogue, emetic for dropsy, gravel, jaundice, substitute for senega; in infusion, decoction, tincture. Dose, 3ss–1 (2–4 Gm.).

## ANISUM. ANISE.

**Pimpinella** }  
**Anisum**, Linné. } The ripe fruit, collected from cultivated plants.

*Habitat.* W. Asia, Egypt, S. E. Europe; cultivated in S. Europe, United States, in gardens.

*Syn.* Aniseed, Aneys, Aunyle, Common Anise, Sweet Cumin, Semen Anisi; Br. Anisi Fructus; Fr. Anis, Anis vert, Graines d'Anise; Ger. Anis, Anissame.

**Pim-pi-nel-la.** L. Medieval name, altered from *bipinnate* or *bipinnella*—i. e., the pinnate leaves; lit. "the two-winged little plant."

**An'i-sum.** L. fr. Gr. ἀνισον—ἀνιστον, Ar. *anisum*, anise, dill—i. e., classic name.

**PLANT.**—Annual herb .3 M. (1°) high; leaves dentate, pinnatifid; flowers white, small, umbels 8–14 rayed. **FRUIT**, cremocarp 5 Mm. (½') long, ovoid, laterally compressed, grayish, greenish-gray, grayish-brown, hairy, mericarps 2, usually cohering and attached to a slender pedicel, each with a flat face and 5 light brown filiform ribs (ridges), 12–16–20 oil-tubes; odor and taste agreeable, aromatic. *Solvents*: alcohol; boiling water partially. Dose, gr. 10–30 (.6–2 Gm.).

**ADULTERATIONS.**—**FRUIT**: Earthy fragments, partly exhausted fruits, recognized by shriveled appearance, chiefly, however, with conium fruit (which resembles mostly the Russian anise), but odor and

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taste not aromatic—becoming mouse-like with solution potassium hydroxide even when 1 p. c. present; non-hairy; consisting usually of single smooth mericarps, grooved upon the face, 5-crenate ribs (ridges) with wrinkles between them, no oil-tubes; POWDER: Star-anise recognized by its peculiar sclerotic cells, earthy matter sinking when stirred in strong brine; OIL: Spermaceti 5–35 p. c., wax, petroleum, fixed oils, oils of turpentine and fennel, camphor (to raise congealing-point), alcohol, fenchone (fennel stearopten); the two first insoluble in cold alcohol, whereas oils and camphor are mostly soluble. Camphors recognized by odor, alcohol by giving milkiness to water; star-anise oil is the same chemically, but has a slight distinguishing smell and taste, also lower congealing-point ( $1^{\circ}$  C.;  $34^{\circ}$  F.).

*Commercial.*—Plant was known and cultivated by Romans; Theophrastus writes of its aromatic properties. Now grown mostly in Malta, Spain, Italy (exported via Leghorn), C. and S. Russia (short), and Chile. The Spanish (Alicante variety), though smaller than French or German, is preferred; that grown by us supplies mostly our market.

*CONSTITUENTS.*—Volatile oil 1–3 p. c., fixed oil 3–4 p. c., choline, resin, sugar, mucilage, malates, phosphates, ash 7 p. c.

*Oleum Anisi.* Oil of Anise, *official.*—(Syn., Fr. Essence d'Anis; Ger. Anethol, Anisöl.) This volatile oil is obtained by distilling the fruit of anise or star-anise (*Illicium verum*); it is a colorless or pale yellow, thin, strongly refractive liquid, characteristic odor of anise, sweetish, aromatic taste, sp. gr. 0.980, increasing with age; contains a liquid body—terpenes and methyl-chavicol,  $C_{10}H_{12}O$ , and a stearopten—anethol,  $C_{10}H_{12}O$ , 80–90 p. c., upon which the value solely depends, by exposure or oxidation with nitric acid converted into anisic acid; star-anise oil same chemically—contains anethol 80–90 p. c., *d*-pinene, *d*-phellandrene, possibly safrol, congeals at  $1^{\circ}$  C. ( $34^{\circ}$  F.), while anise oil at  $10$ – $15^{\circ}$  C. ( $50$ – $59^{\circ}$  F.). *Tests:* 1. Levogyrate at  $25^{\circ}$  C.;  $77^{\circ}$  F. (abs. oil of fennel). 2. Clear in equal volume alcohol, 5 volumes 90 p. c. alcohol (abs. of petroleum, most fixed oils, oil of turpentine). 3. Alcoholic solution of oil is neutral, and should not become blue or brownish with 1 drop ferric chloride T. S. (abs. of volatile oils containing phenols). 4. When shaken with water in graduated tube should not diminish in volume; or dropped into water should not cause milkiness unless agitated (abs. of alcohol). Should be kept dark, in well-stoppered, amber-colored bottles, and if separated into a liquid and solid portion should be liquefied by warming, then well shaken before dispensing. Dose, Mij–5 (.13–.3 Cc.).

*PREPARATIONS.*—OIL: 1. *Aqua Anisi.* Anise Water. (Syn., Fr. Eau d'Anis; Ger. Aniswasser.)

*Manufacture:*  $\frac{1}{2}$  p. c. Triturate oil .2 Cc. with purified talc 1.5

FIG. 283.



Anisum: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

Gm., adding distilled water gradually q. s. 100 Cc. Dose, ʒij–8 (8–30 Cc.).

2. *Spiritus Anisi*. Spirit of Anise. (Syn., Br. *Essentia Anisi*; Fr. *Alcoolat (Esprit) d'Anis*; Ger. *Anisgeist*.)

*Manufacture*: 10 p. c. Dissolve oil 10 Cc. in alcohol q. s. 100 Cc. Dose, ʒj–2 (4–8 Cc.).

3. *Spiritus Aurantii Compositus*,  $\frac{1}{2}$  p. c. 4. *Syrupus Sarsaparillæ Compositus*,  $\frac{1}{5}$  p. c. 5. *Tinctura Opii Camphorata*,  $\frac{2}{5}$  p. c. 6. *Trochisci Glycyrrhizæ et Opii*,  $\frac{1}{3}$  M (.002 Cc.).

*Unoff. Preps.*: FRUIT: *Fluidextract*, dose, Mx–30 (.6–2 Cc.). *Infusion*, 5 p. c., dose, ʒj–8 (4–30 Cc.).

PROPERTIES.—Aromatic stimulant and carminative, stomachic, once supposed a galactagogue, now doubted, although it does impart peculiar taste to secreting milk.

USES.—Flatulent colic, bronchitis, infantile catarrh. As a corrigent to griping cathartics, but here fennel is preferred; much used for flavoring food, confectionery, and in veterinary practice.

#### *Allied Plant:*

1. *Ane'thum (Peuced'anum) grave'olens*, *Dill Fruit*, *Dill Seed* (Br.).—S. Europe, Asia. Herb .6 M. (2°) high; leaves finely divided, glaucous; flowers yellow; fruit oblong, 4 Mm. ( $\frac{1}{8}$ ') long, brown, smooth, mericarps 2, flat-faced, each having 5 ribs, 6 oil-tubes, of which 3 are filiform, 2 lateral ones broadly winged, light colored, odor, and taste spicy, caraway-like; contains volatile oil 3–4 p. c., fixed oil. Used as carminative, stimulant, stomachic, condiment, flavoring; as a substitute for anise and caraway in flatulent colic, hiccough, indigestion. Dose, gr. 10–30 (.6–2 Gm.); volatile oil (oleum anethi, Br.), Mij–5 (.13–.3 Cc.); aqua anethi (Br.), ʒss–2 (15–60 Cc.).

## CARUM. CARAWAY.

**Carum**  
**Carvi (Carui), Linné.** } The dried fruit.

*Habitat*. C. and W. Asia, Himalayas, Caucasus, Europe, Siberia: cultivated in England, Norway, Russia, Germany, Holland, Morocco, United States.

*Syn.* Caraway (Fruit) Seed, Carvies; Br. *Carui Fructus*; Fr. *Carui, Carvi, Cumin des Prés*; Ger. *Fructus Carvi, Kümmel, Gemeiner Kümmel*.

*Ca'rum*. L. *careum*, fr. Gr. *károv*, after *Caria*, in Asia Minor—i. e., its original habitat. *Carui* was the name used by medieval pharmacists for the drug.

*Car'vi*. L. for *carvy, carvey*. Ar. *karawya*, Eng. caraway. Here frequently the word *Carui* is used, thus assimilating L. gen., as though for *Carui Semina*.

PLANT.—Biennial herb; stem .3–1 M. (1–3°) high, hollow; leaves bi- or tripinnate, deeply incised; flowers May–June, small, white, no involucre; root fusiform, fleshy, white, resembles parsnip, and used as food in N. Europe. FRUIT, 2-seeded cremocarp, oblong, flattened, 4 Mm. ( $\frac{1}{8}$ ') long, brown, mericarps 2, curved, tapering towards each end, with 5 yellowish filiform ribs, 6 oil-tubes; seed plane upon the face, nearly equilaterally pentagonal in transverse section; odor and

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taste agreeably aromatic. *Solvents*: alcohol; water partially. Dose, gr. 10–30 (.6–2 Gm.).

**ADULTERATIONS.**—Allied and occasionally exhausted (drawn) fruits, seeds of weeds (likely to indicate starch in the powder), dirt (showing excess of ash).

**Commercial.**—Fruit ripens in Aug. of the second year, when plant is cut down, dried, and thrashed on a cloth. We have several varieties: 1. *English*; 2. *German*; 3. *Holland, Dutch*; 4. *Mogador*; 5. *American*. This last results from cultivating the plant in gardens; the fruit is

FIG. 284.



*Carum Carvi* (*Carui*): flower, fruit, and cross-section of fruit, enlarged.

aromatic, smaller than the German, but with this latter comprises nearly our total supply. The English are the shortest, the Mogador the longest and lightest, and the Holland the finest.

**CONSTITUENTS.**—Volatile oil 5–7 p. c., fixed oil, resin, sugar, gum, tannin, ash 5–8 p. c.; no starch.

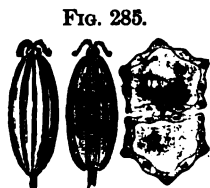
**Oleum Cari.** *Oil of Caraway, official.*—(Syn., Br. *Oleum Carui*; Fr. *Essence de Carvi*; Ger. *Oleum Carvi*, *Carvon*, *Kümmelöl*.) This volatile oil, obtained by distilling caraway with water or steam, and rectifying by steam distillation, is a colorless or pale yellow, thin liquid, characteristic, aromatic odor of caraway, spicy taste, sp. gr. 0.915, soluble in equal volume alcohol, 3–10 volumes 80 p. c. alcohol, dextrogyrate; contains a terpene—carvene,  $C_{10}H_{16}$ , 35–50 p. c. (chemically identical with citrene, hesperidene, *d*-limonene), a ketone—carvone (*d*-carvol),  $C_{10}H_{14}O$ , 50–65 p. c., and an alcohol,  $C_{10}H_{17}OH$ , etc. Carvone may be obtained by treating oil with alcoholic solution ammonium sulphide, decomposing the resulting crystals with potassium hydroxide; it is a viscid, yellowish, oily liquid, creosote odor and taste, closely related to menthol and myristicol, identical with thymol, cuminic alcohol and carvacrol, this latter being the product of distilling a mixture

of caraway oil and potassium or sodium hydroxide (thus expelling carvene), decomposing residue by sulphuric acid, rectifying; useful in toothache, by inserting it into tooth-cavity. Should be kept cooked in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{m}\text{j}-5$  (.13-.3 Cc.).

PREPARATIONS.—I. FRUIT: 1. *Tinctura Cardamomi Composita*, 1 p. c.

II. OIL: 1. *Spiritus Juniperi Compositus*,  $\frac{1}{10}$  p. c.

Carum : fruit and longitudinal section, 3 diam.; transverse section, 8 diam.

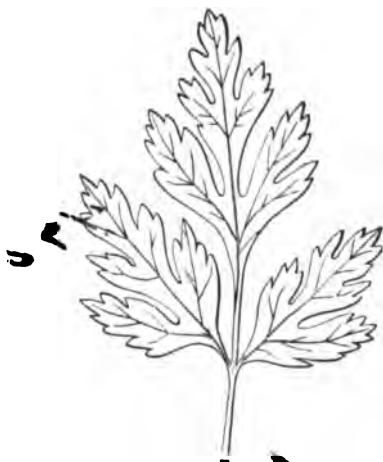


Unoff. Preps. : I. FRUIT: *Aqua Carui* (Br.), 50 Gm. + water 1,000 Cc., distil 500 Cc. *Fluid-extract*, dose,  $\mathfrak{m}\text{x}-30$  (.6-2 Cc.). *Infusion*, 5 p. c., dose,  $\mathfrak{z}\text{j}-2$  (30-60 Cc.). II. OIL: *Spirit* (*Spiritus*).

PROPERTIES.—Carminative, stimulant, diuretic, stomachic.

USES.—Flatulent colic, especially for infants, corrective to nauseous purgatives, flavoring, toothache (carvacrol), as a spice in cakes, bread, etc. The oil is used mostly, which acts externally like other essential oils, as an anæsthetic, etc.

FIG. 286.



*Apium* (*Carum*) *Petroselinum* pinnate leaf.

#### Allied Plants:

1. *Ap'ium* (*Carum*) *Petroseli'num*, Common or Garden Parsley.—The root, official 1820-1880. S. Europe, cultivated as a garden plant. Annual herb, .6-1.2 M. (2-4°) high, with radical and cauline leaves, 3-pinnate; flowers yellow; fruit 2 Mm. ( $\frac{1}{12}$ ') long, ovate, greenish-brown, mericarps with 5 ribs, 4 oil-tubes; contains volatile oil, resin, fixed oil, apiin, (glucoside),  $\text{C}_{24}\text{H}_{28}\text{O}_{13}$ , apiol (parsley camphor), cariol; root conical, 15 Cm. (6') long, 12 Mm. ( $\frac{1}{2}$ ') thick, yellowish, contains volatile oil, apiin, starch. Used as diuretic (nephritic), carminative, discutient for dropsy, gravel, strangury, gonorrhœa, neuralgia, amenorrhœa, in infusion, tincture.

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Dose, 3ss–1 (2–4 Gm.). *Apiol* is an oleoresin, obtained by percolating fruit with alcohol, reclaiming and separating oily residue from the deposited waxy solid; as such it is a greenish oily liquid, which may be made to form white crystals,  $C_{12}H_{14}O_4$ , known as white apiol. Dose, m or gr. 5–8 (.3–.5 Gm.), in dysmenorrhœa, amenorrhœa, beginning 3–4 days preceding menstruation.

2. *A. graveolens*, *Celery* (Fruit).—S. Europe, cultivated. Fruit 1 Mm. ( $\frac{1}{25}$ ') long, ovate, flattened, brown, smooth, mericarps 2, 5 ribs, 12 oil-tubes; contains volatile oil, fixed oil; root, fusiform, white, when wild poisonous; under cultivation, harmless; blanched stalks popular as a salad. Used as carminative, stimulant, flavoring (in infusion, juice), for bronchitis, intermittents, contusions, swollen glands. Dose, gr. 15–30 (1–2 Gm.).

## CORIANDRUM. CORIANDER.

*Coriandrum* }  
*sativum*, Linné. } The dried ripe fruit.

*Habitat.* C. Asia, S. Europe (China, Italy; cultivated in the United States, Europe).

*Syn.* Coliander; Br. Coriandri Fructus; Fr. Coriandre; Ger. Koriander (samen).

*Co-ri-an'drum.* L. fr. Gr. κόρις, a bug—i. e., from a resemblance in odor of the leaves.

*Sa-ti'vum.* L. *sativus*, sown, cultivated—i. e., kind used, in contradistinction to the wild-grown.

**PLANT.**—Annual herb, odor of bed-bugs; stem .3–.6 M. (1–2°) high, solid; leaves bi- or tripinnate; leaflets linear, pointed, lobed, light green, resembling parsley; flowers June, white, rose-colored, umbels small, 4 Cm. ( $1\frac{3}{8}$ ') broad, 5–8-rayed. **FRUIT**, Aug., cremo-carp, globular, 4 Mm. ( $\frac{1}{6}$ ') thick, crowned with calyx-teeth and short stylopodium, brownish-yellow; the 2 mericarps usually united, each with 5 prominent, straight primary ribs and 4 indistinct secondary ribs, inner surface deeply concave and with 2 oil-tubes; odor and taste agreeably aromatic. *Solvent*: alcohol; water partially. Dose, gr. 10–30 (.6–2 Gm.).

**ADULTERATIONS.**—**FRUIT**: Stems, fragments of leaves; **OIL**: Oils of turpentine, sweet orange, cubeb and cedar-wood—all recognized by being less soluble in 70 p. c. alcohol.

*Commercial.*—Coriander was popular with the ancients. In the fresh state all parts upon being bruised are fetid; the fruit becomes fragrant only by drying, and when ripe, plants are cut down with sickles, dried, and fruit thrashed out. We produce largely our own supply; some, however, are imported from Europe; those from Bombay (Indian) are larger and ovoid, but seldom reach the United States.

**CONSTITUENTS.**—Volatile oil 0.5–1 p. c., fat 13 p. c., tannin, malic acid, mucilage, ash 5 p. c.

FIG. 287.



Coriandrum: fruit and longitudinal section magnified 8 diam.; transverse section magnified 8 diam.



**Oleum Coriandri.** Oil of Coriander, *official.*—(Syn., Fr. Essence de Coriandre; Ger. Korianderöl.) This volatile oil, distilled from fruit, crushed between rollers, with water or steam, is a yellowish liquid, characteristic, aromatic odor of coriander, warm, spicy taste; sp. gr. 0.875; soluble in 3 volumes of 70 p. c. alcohol, in all proportions of 80–90 p. c. alcohol; contains a terpene—pinene,  $C_{10}H_{16}$ , 5 p. c., and an alcohol—linalool (coriandrol),  $C_{10}H_{18}O$ , 90 p. c., from which 1 molecule of  $H_2O$  can be withdrawn, leaving  $C_{10}H_{16}$ . Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{mij}$ –5 (.13–.3 Cc.).

PREPARATIONS.—I. FRUIT. (Unoff.) *Fluidextract*, dose,  $\text{Mxv}$ –30 (1–2 Cc.). *Infusion*, 5 p. c., dose,  $\text{3j}$ –2 (30–60 Cc.).

II. OIL: 1. *Confectio Sennæ*,  $\frac{1}{2}$  p. c. 2. *Spiritus Aurantii Compositus*, 2 p. c. 3. *Syrupus Sennæ*,  $\frac{1}{2}$  p. c.

PROPERTIES.—Aromatic, carminative, stimulant, stomachic.

USES.—Indigestion, flatulency, corrective to griping medicines, such as senna, rhubarb, jalap; flavoring to gin and in cooking. Oil also used in colic, rheumatism, neuralgia.

## CONIUM. CONIUM.

**Conium maculatum**, Linné. } The full-grown but unripe fruit, carefully dried, preserved, and containing 0.5 p. c. of coniine.

*Habitat.* Europe, Asia, N. Africa (naturalized in N. and S. America, waste places and along streams—England, Scotland, Greece, Italy, Spain, United States).

*Syn.* Hemlock, Poison Hemlock—Root—Parsley or Snakeweed, Spotted Hemlock—Conium—Cowbane or Parsley, Beaver Poison, Musquash Root, Water Parsley, Wild or Water Hemlock, Cicuta; Br. Conii Fructus; Fr. Grand Ciguë, Ciguë officinale or ordinaire; Ger. Herba Conii, Schierling, Gefleckter Schierling.

**Conium**. L. fr. Gr. *κόνιον*, *κωνάω*, to whirl around—i. e., it produces giddiness when taken.

**Mac-u-la'tum**. L. *maculatus*, spotted, fr. *macula*, a spot—i. e., stem has brownish-purple dots.

PLANT.—Biennial, stem 2–2.5 M. (6–8°) high, round, furrowed, hollow, smooth, green, mottled with port-wine-colored spots, covered with white bloom; root whitish-yellow, fusiform, 12–18 Mm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') thick, exuding a milky juice when cut; flowers June–July, white, small umbels 10–20-rayed; leaves bipinnate, 15–30 Cm. (6–12') long, pinnæ lanceolate, incised, dentate, mucronate, glossy beneath, grayish-green upon drying; odor of mice urine; taste nauseous, saline, bitter, acrid. FRUIT, cremocarp, broadly ovate, greenish-gray, the two carpels (mericarps) usually separated, each 3 Mm. ( $\frac{1}{8}$ ') long, 1.5 Mm. ( $\frac{1}{16}$ ') broad, ovoid, curved, inner flattened side with deep longitudinal groove, the outer convex side with 5 pale yellow crenate ribs, intervening surfaces wrinkled but otherwise smooth, pericarp without oil-tubes; odor slight, but when triturated with solution potassium hydroxide, strong, disagreeable, mouse-like; taste characteristic, disagreeable, acrid. Unfit for use when more than two years old. *Solvent*: alcohol. Dose, gr. 1–5 (.06–.3 Gm.).

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**ADULTERATIONS.**—Several umbelliferous fruits, especially anise, which has similar appearance but is aromatic, with 2 mericarps flat-faced, each with 5 ribs and 12–20 oil-tubes.

**Commercial.**—This was the *κόνιον* of Greek writers, and the celebrated Athenian *State poison* in the form of decoction or juice. By this, Socrates, Phœcion, and many others died. Virgil and other Latin

FIG. 288.

*Conium maculatum.*

authors spoke of it as *cicuta*. The wild and cultivated plants of dry, hot climates, in sunny exposures, are more active, and from either indiscriminately the fruit should be collected in Aug., dried in the dark, and kept unexposed in tight vessels, when they will remain active several years.

**CONSTITUENTS.**—Coniine (Conine) 0.5–1.5 p. c., Methylconiine, Conhydrine, pseudoconhydrine,  $C_8H_{17}NO$ , ethyl-piperidine,  $C_7H_{15}N$ , volatile oil, fixed oil, coniic (conic) or malic acid, ash 6 p. c.

**Coniine**,  $C_8H_{17}N$ .—This liquid alkaloid exists combined with malic or coniic acid, and is obtained by distilling with potassium hydroxide and water, when it comes over with the volatile oil, or may add ammonia to the drug or the extract and distil; neutralize distillate with  $H_2SO_4$ , evaporate to dryness, add ether or alcohol to dissolve alkaloids, thereby precipitating alkali sulphate, evaporate filtrate, and liberate coniine by adding potassium hydroxide, extract with ether, purify by distilling in current of hydrogen. It is when pure a colorless, acrid, almost odorless liquid, sp. gr. 0.844, boils at  $166^\circ C.$  ( $330^\circ F.$ ), congeals at  $-2^\circ C.$

(28° F.); commercial product is contaminated usually to a large extent with coniceine, giving it a yellowish color, with disagreeable mousy odor; forms white crystalline salts, soluble in water, alcohol (hydrobromide, hydrochloride, sulphate, etc.). Dose,  $\mathfrak{M}_{\frac{1}{10}}-\frac{1}{8}$  (.003-.01 Cc.); salts, gr.  $\frac{1}{20}-\frac{1}{8}$  (.003-.01 Gm.).

**Methylconiine**,  $\text{C}_8\text{H}_{16}\text{CH}_3\text{N}$ .—Resembles coniine, with which commercial alkaloid it is usually associated.

**Conhydrine (Oxy-coniine)**,  $\text{C}_8\text{H}_{17}\text{NO}$ .—May be separated from coniine by exposing mixed alkaloids to a freezing mixture, expressing,

crystallizing repeatedly from ether; occurs in iridescent scales, less poisonous than coniine, with  $\text{P}_2\text{O}_5$  yields poisonous coniceine,  $\text{C}_8\text{H}_{15}\text{N}$ .

**Assay**: Exhaust powdered drug 10 Gm. with 100 Cc. of solution (ether 98, alcohol 8, ammonia water 3), add to 50 Cc. clear liquid normal sulphuric acid V. S. for acidity, evaporate off ether, add alcohol 15, let ammonium sulphate deposit, nearly neutralize filtrate with sodium carbonate T. S., concentrate, add ether 15, 15, to remove fat, which discard, add to acid liquid piece of red litmus paper + sodium carbonate

T. S. to make alkaline, shake out with ether 15, 15, 10, acidify combined ether solutions with hydrochloric acid solution (5 p. c.), evaporate ether, add alcohol 3, 3, evaporating to dryness each time, weigh final residue, multiply weight by 0.777, and the product by 20 = p. c. of coniine present.

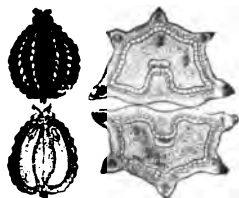
**PREPARATIONS**.—1. *Fluidextractum Conii*. Fluidextract of Conium. (Syn., *Extractum Conii Fluidum*, U. S. P. 1890, *Extractum Conii Fructus Fluidum*, Fluidextract of Hemlock Fruit; Fr. *Extrait liquide de Semence (fruit) de Ciguë*; Ger. *Flüssiges Schierlingsfrucht-extrakt*.)

**Manufacture**: Macerate, percolate 100 Gm. with diluted alcohol 98 Cc., acetic acid 2, finishing with former alone q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.45 Gm. of coniine. **Assay**: Evaporate 10 Cc. with a little sand to dryness, add 100 Cc. of mixture (ether 100, alcohol 7, ammonia water 3), shake, decant 50 Cc., and proceed approximately as in assay of conium. Dose,  $\mathfrak{M}_{\text{j}}-5$  (.06-.3 Cc.).

**Unoff. Preps.**: *Extract*, dose, gr.  $\frac{1}{2}-2$  (.03-.13 Gm.). *Succus Conii* (Br.), expressed juice of fresh leaves and branches 3 parts + alcohol 1, set aside for a week, dose,  $\mathfrak{zss}-2$  (2-8 Cc.). *Tinctura Conii* (Br.), 20 p. c. (alcohol), dose,  $\mathfrak{M}_{\text{xv}}-60$  (1-4 Cc.). *Unguentum Conii* (Br.), juice 73 p. c. (evaporate, add base). *Abstract*, dose, gr.  $\frac{1}{2}-2$  (.03-.13 Gm.).

**PROPERTIES**.—Sedative, narcotic (used by ancients as such, fell into neglect and was revived by Störck), poisonous (no effect on horses, goats, sheep), anodyne, soporific, antispasmodic, anaphrodisiac. It mainly depresses functional activity of all motor nerves, beginning in

FIG. 289.



Conium: fruit and longitudinal section magnified 8 diam.; transverse section magnified 8 diam.

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the peripheries, then ascending and involving spinal cord, thereby causing motor paralysis without loss of sensation.

**USES.**—Spasmodic chorea, whooping-cough, mania, melancholy, neuralgia, delirium tremens, tetanus, asthma, epilepsy, convulsions, phthisis, bronchitis, pneumonia, pleurisy, when excessive motor activity present; externally—scrofulous glandular sores, affections of mammary gland, to check secretion of milk, cutaneous affections, toothache, usually in form of poultice.

**Poisoning:** Have vomiting, fatigue or heaviness of the legs, numbness, drooped eyelids, mydriasis, vertigo, impaired speech, inability to swallow, slow pulse, labored breathing, paralysis of voluntary muscles, first of lower limbs, loss of speech and vision, and finally death from paralysis of respiratory muscles. Heart and brain not affected. Give emetics or lavage, tannin, then wash stomach again, strychnine, picrotoxin, alcoholic stimulants, coffee, atropine (hypodermically), external warmth and epispastics, demulcents, artificial respiration.

**Incompatibles:** Tannic acid, caustic alkalies, astringents, strychnine, picrotoxin.

**Synergists:** Motor depressants (aconite, veratrum, gelsemium, tobacco, hydrocyanic acid), morphine, etc.

**Conii Folia, Conium Leaves (Br.).**—U. S. P. 1820–1880. These should be collected while plant is in bloom, footstalks rejected, and carefully dried by the sun or fire (49° C.; 120° F.). Should then be kept tightly in tin boxes or, better, powdered and put in well-stoppered bottles, otherwise coniine, being very volatile, escapes, leaving a worthless product.

**Allied Plant:**

1. *Æthusa Cynapium*, *Fool's Parsley*, *Small Hemlock*.—Leaves non-poisonous, and sometimes carelessly mixed with those of conium. Plants are easily distinguished, as *Æthusa Cynapium* has leaves of different shape, darker color, leek-like odor. Occasionally we have mixed also the pubescent ciliate leaflets of several species of *Chærophyl'lum*.

FIG. 290.



ASAFETIDA. ASAFETIDA.

**Ferula foetida**, (Bunge) Regel, } A gumresin from the root.  
and probably other species.

**Habitat.** Persia, Turkestan, Afghanistan.

**Syn.** Devil's Dung, Food of the Gods, Cibus Deorum, Gummi-resina Asafetida; Fr. Asse-fétide; Ger. Asa foetida, Asant, Stinkasant, Teufelsdreck.

**Fer'u-la.** L. fr. ferio, ferire, to strike—i. e., stems used as rods, with which, at one time, schoolboys were punished.

**Fœt'i-da.** L. foetidus, fetid, stinking—i. e., the odor of the plant, and its secretion; with Pers. prefix *azu*, mastic, + *foetida*, forms the official and common names, *as'a-fet'i-da*, *as'a-fet'i-da*—i. e., stinking mastic.

PLANT.—This particular species was discovered by Lehmann, 1841, in Turkestan and Bokhara, and by Bunge, 1858 (*Scorodos'ma fœ'tidum*), in W. Afghanistan; it is a large, perennial herb, enduring several years, but always perishes after flowering; stem 1.5–3 M. (5–10°) high, 2.5–12.5 Cm. (1–5') thick, greenish, erect, furrowed, smooth; leaves few, radical and cauline, mostly near stem's base, .3–.6 M. (1–2°) long, same width, on stout, round petioles, 22.5 Cm. (9') long, expanding below into inflated sheath surrounding one-half the stem,

FIG. 291.

*Ferula fortida.*

compound, ternately divided, each bipinnate with few pinnæ, leaflets few; flowers small, monœcious, pale yellow; root conical, 45 Cm. (18') long, 10–15 Cm. (4–6') thick, dark brown, inside whitish. GUM-

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RESIN (asafetida), in irregular masses composed of variable size tears embedded in yellowish-brown matrix; when fresh, the tears are tough, yellowish-white, translucent, or milky-white and opaque, changing on exposure to pinkish, reddish-brown, 0.6–2.5 Cm. ( $\frac{1}{4}$ –1') in diameter, flattened, hard and brittle by drying, freshly fractured surface greenish with nitric acid, odor persistent, alliaceous; taste bitter, alliaceous, acrid. Tears alone should be used in medicine. *Tests*: 1. Triturated with water, get milk-white emulsion, becoming yellowish on the addition of ammonia water. 2. Alcohol should dissolve at least 50 p. c., and when incinerated the ash should be not more than 10 p. c. *Solvent*: alcohol. Dose, gr. 3–10 (.2–.6 Gm.).

ADULTERATIONS.—Divisible into 4 groups: 1, plant's tissues (insoluble in alcohol); 2, local associated gums; 3, earthy substances (ash, alcohol-insoluble residue); 4, turpentine products. Although some of these are added after reaching Europe, most of the adulterating occurs in its native country at Herat, before being conveyed to Bombay, where are used red clay (tawah), sand, stones, wheat or barley flour, gypsum, calcium carbonate, calcium sulphate, cloth, bristles, wood, rosin, resins, translucent gums, in all amounting sometimes to 60–80 p. c., often yielding an ash 16–22 p. c. +.

*Commercial*.—Known in the East from early ages. In April, when the leaves begin to wither, collection is started by removing the soil around upper portion of the root, 5–7.5 Cm. (2–3') in depth, pulling off leafy stem and cutting a slice from the top, whereupon milky juice exudes, but is not collected; this exposed surface is protected now against the heat of the sun by a covering (khora), a domed structure several inches high made of twigs covered with clay, save an opening on the north. In about 40 days (May) the collectors return, finding the exposed surface exuding a thick, gummy, not milky, reddish substance in more or less irregular lumps, resembling ordinary asafetida, which is scraped off, or removed along with a slice of the root, and put into leather (kid or goat) bags; this operation can now be repeated at 10-day intervals until the root is exhausted and perished (2 months), each succeeding cutting yielding a thicker and better juice, provided the root is screened all the while from the sun. The product from many plants is mixed and further hardened in the sun; each root yields  $\frac{1}{2}$ –32 ounces (.015–1 Kg.), and plants under 4 years of age are unproductive. It enters commerce via Bombay, in skins, mats (80–90 pounds; 36–40.5 Kg.), boxes (200–400 pounds; 91–182 Kg.), and casks. The purest is usually soft, called natively *hing*, and from its transparency is thought to be from the stem; this is used in India, while the mixed, called *hingra*, alone is exported. Asafetida can be powdered when excessively cold or after drying over unslaked lime for two weeks in a closed vessel; it retains powdered form best when kept in paper packages over lime. We have several commercial varieties:

1. *Amygdaloid*.—This, also called the *lump* variety, is the official kind, and is considered to be the most reliable.

2. *Tears*.—This is inferior, consisting of various-sized tears (pea to

a walnut), yellowish, roundish, flattened, oval, irregular-shaped, distinct or adhesive and agglutinated.

3. *Stony*.—Various-sized, angular or rounded pieces of gypsum and other earthy matters, agglutinated or merely coated with the milky juice; this should not be used in medicine.

4. *Liquid*.—This is a white, opaque, syrupy, or semi-fluid mass, by age turning brown; may be the first exudation, or due to moist season.

CONSTITUENTS.—Gum 20–30 p. c., Resin 60–70 p. c., Volatile oil 6–9 p. c., vanillin 0.06 p. c., free ferulic (ferulaic) acid 1.3 p. c., free asaresino-tannol 1 p. c., formic, acetic, valerianic and malic acids, ash 3–4 p. c.

**Gum**.—Partly soluble in water, the residue (bassorin) dissolves in alkalies, being reprecipitated by acids.

**Resin**.—Reddish-brown, amorphous, soluble in ether except 3–4 p. c. It is the ferulic acid ester of asaresino-tannol, and contains ferulic acid,  $C_{10}H_{10}O_4$ , and resino-tannol,  $C_{24}H_{33}O_5$ ; upon dry distillation yields umbelliferon,  $C_8H_6O_3$ , and blue-colored oils; when fused with potassium hydroxide gives resorcin and protocathechuic acid.

**Volatile Oil**.—To this the odor and stimulating property are due, and is obtained by distilling with water or alcohol, sp. gr. 0.980. It is a mixture of several sulphides of ferulyl, ( $C_7H_{14}S_2$  and  $C_{11}H_{20}S_2$ ), two terpenes, ( $C_{10}H_{16}$  and  $C_{10}H_{16}O$ ), the latter yielding a sesquiterpene,  $C_{15}H_{24}$ , and a blue-colored oil in the higher boiling portions.

PREPARATIONS.—1. *Emulsum Asafetidæ*. Emulsion of Asafetida. (Syn., *Mistura (Lac) Asafetidæ*, Milk of Asafetida; Fr. *Mixture (Lait) d'Asafétide*; Ger. *Asafetidaemulsion*, Stinkasantmilch.)

*Manufacture*: 4 p. c. Rub asafetida 4 Gm. in a mortar, gradually adding water q. s. 100 Cc.; strain. Dose, 3ss–1 (15–30 Cc.).

2. *Pilulæ Asafetidæ*. Pills of Asafetida. (Syn., Fr. *Pilules d'Aséfétide*; Ger. *Asafetidapillen*.)

*Manufacture*: Asafetida 20 Gm., soap 6, water q. s. 100 pills. Dose, 2–5 pills.

3. *Tinctura Asafetidæ*. Tincture of Asafetida. (Syn., Fr. *Teinture d'Aséfétide*; Ger. *Tinctura Asæ-fetidæ*, Stinkasanttinktur.)

*Manufacture*: 20 p. c. Macerate 20 Gm. 3 days with frequent agitation in a closed vessel, with alcohol q. s. 100 Cc., filter. Dose, 3ss–1 (2–4 Cc.).

*Unoff. Preps.*: *Asafetida Præparata*—exhaust with alcohol, pour solution into slightly acidulated water, thus eliminating gum, without loss of resin and volatile oil. *Spiritus Ammoniac Fetidus* (Br.), asafetida 7.5 p. c., dose, 3j–2 (4–8 Cc.). *Devees' Carminative*, dose, 3ss–4 (2–15 Cc.). *Pil. Galbani Comp.* (Br.), dose, 2–4 pills. *Plaster. Suppositories. Enema* (1 to 64 water).

PROPERTIES.—Similar to other drugs with volatile oils; stimulant, antispasmodic, expectorant, laxative, (emmenagogue, anthelmintic, condiment).

USES.—Hysteria, hypochondriasis, convulsions, spasms, whooping-cough, measles, asthma, coughs, catarrhs, flatulent constipation, chorea, nervous apoplexy, consumption. Used in India, Persia, etc., as a con-

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diment, for flavoring food, etc., like garlic and onions.. Acts here as a stimulant to the bowels and digestion. The natives value it highly, not only for its agreeable effect, but also for the odor and taste; a tolerance of this latter in most cases is acquired gradually by usage, as at first it is often nauseous and positively disgusting.

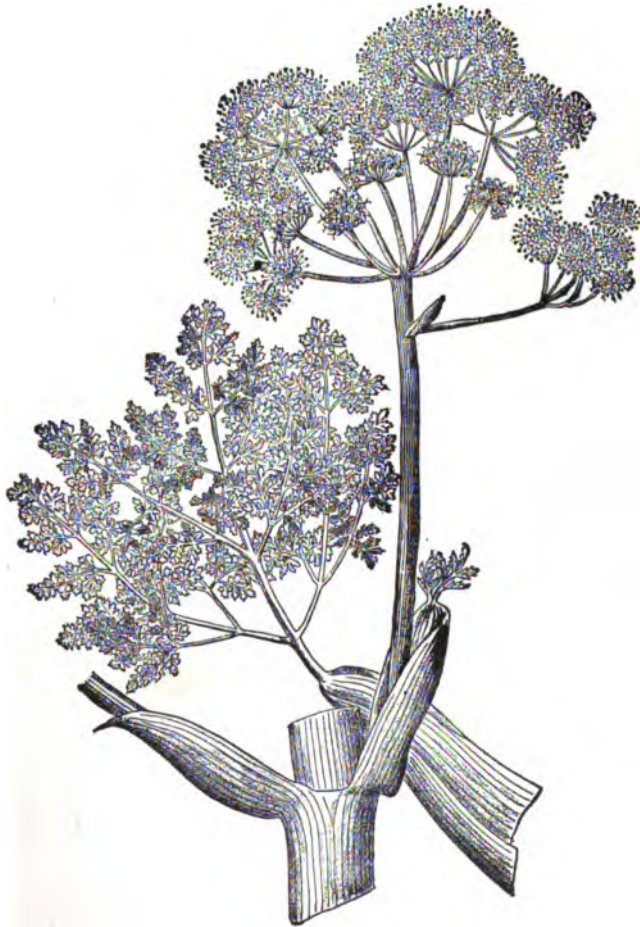
*Incompatibles:* Cerebral and arterial depressants, cold, acids, neutral salts; water with alcoholic liquid preparations.

*Synergists:* Cerebral excitants, alcohol, ether, gumresins, balsams, aromatics, volatile oils containing sulphur and phosphorus.

*Allied Plants:*

1. *Ferula Nar'thez* (*Narthex assafæt'ida*).—Official 1820–1890.

FIG. 292.

*Ferula galbaniflua.*

This plant is almost identical with *F. fetida*, and from it much gum-resin is collected and sent in with the official. It is almost impossible to recognize plant origin by the product.



2. *F. galbaniflua*, *Galbanum*.—Gumresin, official 1820–1890. N. Persia. Plant 1.3–1.6 M. (4–5°) high, 2.5 Cm. (1') thick, solid, striate leaves radical and cauline; flowers yellow; fruit 12 Mm. ( $\frac{1}{2}$ ') long, winged near face of mericarps. Gumresin in tears size of pin-head to that of a pea, brownish-yellow, inside milk-white, waxy, odor peculiar, balsamic, taste bitter, acrid, with water gives milky emulsion. Obtained from incisions; contains gum 15–20 p. c., resin 60–66 p. c., volatile oil 10–20 p. c., free umbelliferon 0.25 p. c., umbelliferon combined with galbano-resino-tannol 20 p. c., ash 8–10 p. c. Used as stimulant, expectorant, antispasmodic, for hysteria, chlorosis, catarrh, amenorrhœa, rheumatism, bronchitis, for church incense, tumors, boils, in pill (*pilula galbani composita*, Br.), emulsion, tincture, plasters. Dose, gr. 5–20 (.3–1.3 Gm.). It is intermediate between *asafetida* and *ammoniac*.

## SUMBUL. SUMBUL.

**Plant**  
**undetermined.** } The dried rhizome and root.

*Habitat.* C. and N. Asia (Turkestan, Bucharia, E. Siberia, Russia).

*Syn.* Musk Root; Br. *Sumbul Radix*; Fr. *Racine de Sumbul*; Ger. *Sumbulwurzel*, *Moschuswurzel*.

**Sum'bul.** L. fr., Ar., Pers., Hind., *sumbul*, *spikenard*—their native name, *sumboul*, a spike—i. e., the appearance of the flowering stem.

**PLANT.**—The root of *Ferula Sumbul*, or true musk-root, has not been on our market for years, that now taking its place being more correctly “false musk-root or *sumbul*,”

FIG. 293.



Sumbul root: section.

whose plant source absolutely is unknown; it enters commerce from C. and W. Asia through Moscow, the thick annulate portion being rhizome, the small smooth pieces roots. **RHIZOME**, in transverse segments, variable lengths, .5–10 Cm. ( $\frac{1}{5}$ –4') thick, dusky brown, annulate, longitudinally wrinkled, or with smooth, silver-gray periderm, fracture short-fibrous, light brown or brownish-yellow, spongy, porous, with numerous brownish-yellow resin reservoirs, and irregular, easily separable fibres, bark .5 Mm. ( $\frac{1}{50}$ ') thick; odor strong, musk-like; taste bitter. *Solvent*: alcohol 65–75 p. c. Dose, gr. 10–30 (.6–2 Gm.).

**CONSTITUENTS.**—Volatile oil (bluish, peppermint taste), 0.33–1 p. c., Resin (soft, musk odor) 9 p. c., fixed oil 17 p. c., angelic acid (sumbulic acid),  $C_5H_8O_2$ , valerianic acid,  $C_6H_{10}O_2$ , methylcrotonic acid, bitter extractive, sugar, starch. Dry distillation gives bluish volatile oil, containing umbelliferon.

**PREPARATIONS.**—1. *Fluidextractum Sumbul*. Fluidextract of Sumbul. (Syn., Fluidextract of Muskroot; Fr. *Extrait liquide de Sumbul*; Ger. *Flüssiges Sumbulwurzel* (Moschuswurzel)-extrakt.)

## UMBELLIFERÆ.

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose,  $\text{m}\times\text{--}30$  (.6–2 Cc.).

*Prep.*: 1. *Extractum Sumbul.* Extract of Sumbul. (Syn., Extract of Muskroot; Fr. *Extrait de Racine de Sumbul*; Ger. *Sumbul (Moschus)-wurzelextrakt.*)

*Manufacture*: Evaporate cautiously to pilular consistence fluidextract of sumbul 100 Cc.; yield 15 p. c. Dose, gr. 2–5 (.13–.3 Gm.).

*Unoff. Preps.*: *Tincture*, 10 p. c., dose, 3ss–2 (2–8 Cc.). *Resin*, dose, gr. 1–2 (.06–.13 Gm.).

**PROPERTIES.**—Stimulant, carminative, tonic nervine (resembles musk and valerian), antispasmodic.

**USES.**—Hysteria, female nervousness, epilepsy, chlorosis, amenorrhœa, asthma, delirium tremens, bronchitis, leucorrhœa, gleet, typhoid, atonic dysentery, hypochondriasis. Often combined with asafetida in nervous troubles, and with iron, arsenic, etc., in chlorosis.

*Incompatibles* and *Synergists*: Same as for asafetida; all preparations immiscible with water.

*Allied Plants*:

1. *Fer'ula Sum'bul.*—Root fusiform, vertical, 12–25 Cm. (5–10') long, 5–10 Cm. (2–4') thick, in sections similar to the official, but less annulate, strong musk odor.

2. *Dore'ma Ammoni'acum, Ammoniacum, Ammoniac.*—The gumresin, official 1820–1900. E. Persia, Turkestan. Plant of striking appearance, dying after flowering; stem 1.6–2 M. (5–7°) high, greenish, joints greenish-purple; flowers small, white; leaves—radical and cauline. Gumresin (ammoniac) exudes from stem and root, through fissures (due to varying temperature) or animal and insect punctures. It is in *tears* or *cakes*, the former preferred when 1.5–6 Mm. ( $\frac{1}{16}$ – $\frac{1}{4}$ ') thick, yellowish, fracture conchoidal, waxy, milk-white; odor peculiar; taste acrid, bitter, nauseous; contains gum 18–28 p. c., resin 70 p. c., volatile oil 1–4 p. c., ash 1–4 p. c. Stimulant, expectorant, rubefacient, similar to but less powerful than asafetida; bronchitis, chronic catarrh, asthma, pleurisy; externally resolvent in white swelling, tumors, glandular enlargements. Dose, gr. 10–30 (.6–2 Gm.); emulsion (water—milky), 4 p. c., 3ss–1 (15–30 Cc.). The root, known in commerce as Bombay Sumbul or Boi, is of closer texture, firmer, denser, and more reddish than the official sumbul, for whose adulteration it is used, but resembles more closely the root of true sumbul (*Ferula Sumbul*).

FIG. 294.



Dorema Ammoniacum.

3. *D. Au'cheri*.—W. Persia. Yields a similar product (ammoniac), while *D. robus'tum* gives a dissimilar gumresin.

4. *Ferula tingita'na*, *African Ammoniac*.—This is thought to be the "ammoniacum" of the ancients; it is darker than our ammoniac, odor agreeable, like benzoin, taste acrid, bitter; contains gum 9 p. c., resin 68 p. c., and yields umbelliferon.

FIG. 295.

*Cornus florida*.

5. *Opop'anax Opop'anax* (*Chiro'nium*).—S. Europe. Root and stem exude yellowish milk, hardening into reddish-brown tears, having a waxy lustre, and a bitter, balsamic taste.

6. *Cor'nus flor'ida*, *Flowering Dogwood*.—Cornaceæ. The bark of root, official 1830–1890. N. America. Small tree, 4.5–10.5 M. (15–35°) high, 12.5–25 Cm. (5–10') thick, flowers greenish with 4 large white involucral leaves, petaloid; fruit bright red. Bark deprived of the furrowed brown-gray outside corky layer, in curved

pieces 3 Mm. ( $\frac{1}{8}$ ') thick, reddish-brown color, striate, astringent, bitter; contains cornin (cornic acid), tannin 3 p. c., resin. Used as astringent, tonic, febrifuge, stimulant, as substitute for cinchona, when fresh emetic; in decoction, fluidextract. Dose, gr. 15–60 (1–4 Gm.).

7. *C. circina'ta*, *Round-leaved Dogwood*.—The bark, official 1820–1880. N. America. Shrub 1.6–3 M. (5–10°) high, branches greenish, warty; leaves round, 10–12.5 Cm. (4–5') wide, woolly beneath; flowers white cymes; fruit, blue drupe. Bark quilled, curved, greenish, brownish-gray, with suberous warts or longitudinal lines, inside cinnamon-brown. Used as the *C. florida*, but is more bitter and less astringent.

8. *C. Amo'num* (*seric'ea*), *Silky Cornel*, *Swamp Dogwood*.—The bark, official 1820–1880. N. America. Shrub 1.6–3 M. (5–10°) high, branches purple; leaves elliptical, silky beneath; flowers yellowish, woolly cymes; fruit pale blue. Bark quilled, thin, outside purplish-brown, less warty than preceding, otherwise resembling. Used like *C. florida*, but is less bitter and astringent.

## PYROLACEÆ.

SERIES 2: GAMOPETALÆ. Petals more or less united, rarely separate or wanting.

## 62. PYROLACEÆ. Wintergreen Family.

Pir-o-la'se-e. L. *Pyrol-a* + aceæ, dim. of *pirus* (*pyrus*), a pear-tree, fr. Celtic *peren*, pear. Low, mostly evergreen perennials. Distinguished by leaves petiolate; flowers perfect, white or pink, calyx 4-5-lobed, corolla deeply 4-5-parted or 5 petals, stamens 8-10; ovary 4-5-celled, superior, stigma 5-lobed; fruit capsule, dehiscent; temperate climates; diuretic (nephritic), astringent, tonic.

Genus: 1. *Chimaphila*.

## CHIMAPHILA. CHIMAPHILA.

*Chimaphila umbellata*, (Linné) Nuttall. } The dried leaves.

*Habitat.* N. America, N. Asia, N. and C. Europe; in dry woods.

*Syn.* Pipsissewa, Chimaphila, Prince's Pine, Rheumatism Weed, King's Cure, Wintergreen, Bitter Wintergreen, Ground Holly, Noble Pine, Pyrola, Pine Tulip; Fr. Herbe de Pyrole ombellée; Ger. Doldenblüthiges Harnkraut, Wintergrün.

*Chimaph'1-la.* L. fr. Gr. *χειμα*, winter, + *φιλος*, loving—i. e., remains green all winter, as though loving that season.

*Um-bel-la'ta.* L. *umbellatus*, umbellated—i. e., flowers in corymbose umbels.

*Pip-sis'-se-wa.* American Indian name.

PLANT.—This is known also as *Chimaphila corymbo'sa* and *Pyr'ola umbella'ta*; it is a perennial, 10-25 Cm. (4-10') high, with the leaves near stem's apex; rhizome yellowish, creeping; flowers June-July, white, tinged with red, exhaling perfume, terminal corymb or umbel. LEAVES, oblanceolate, 2.5-5 Cm. (1-2') long, 8-18 Mm. ( $\frac{1}{3}$ - $\frac{1}{2}$ ') broad, upper portion coarsely, sharply serrate, acute or somewhat obtuse, lower wedge-shaped, nearly entire; coriaceous, smooth, uniformly dark green on upper surface, paler beneath; odor slight; taste astringent, bitter. *Solvents*: diluted alcohol; boiling water. Dose, gr. 15-60 (1-4 Gm.).

CONSTITUENTS.—Chimaphilin,  $C_{24}H_{21}O_4$ , arbutin, ericolin, urson, tannin 4 p. c., volatile oil, resin, sugar, gum, ash 5 p. c.

Chimaphilin.—Neutral principle obtained by distilling with water, when its yellow crystals deposit in neck of retort, or may shake diluted alcoholic tincture with water or chloroform, thus dissolving it out; it is inodorous, tasteless, soluble in alcohol, ether, chloroform, slightly in water; gives red with sulphuric acid. The "Eclectic" resinoid, *chimaphilin*, is a dark brown bitter powder. Dose, gr. 2-3 (.13-.2 Gm.).

PREPARATIONS.—1. *Fluidextractum Chimaphilæ.* Fluidextract of Chimaphila. (Syn., Extractum Chimaphilæ Fluidum, U. S. P. 1890, Fluidextract of Pipsissewa; Fr. Extrait liquide de Pyrole ombellée; Ger. Flüssiges Doldenblüthiges Harnkrautextrakt.)

*Manufacture*: Macerate, percolate 100 Gm., with diluted alcohol q. s., evaporate to 100 Cc. Dose, 3ss-1 (2-4 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 3-10 (.2-.6 Gm.). *Decoction*, 5 p. c., dose, 3j-3 (30-90 Cc.). *Poultice*.

PROPERTIES.—Astringent, tonic, diuretic, nephritic; locally rubefacient. About the same as buchu, uva-ursi, pareira, scoparius.

FIG. 296.

*Chimaphila umbellata*: upper part of flowering stem.

USES.—Scrofula, rheumatism, dropsy, scanty urine, gravel, hæmaturia, gonorrhœa, skin and kidney affections, diarrhœa, gout; checks uric acid secretion; externally to ulcers, tumors.

*Allied Plants:*

1. *Chimaphila macula'ta*, *Spotted Wintergreen (Pipsissewa)*.—The leaves, official 1830–1840. N. America. Herb, 7.5–15 Cm. (3–6') high, leaves 2.5–5 Cm. (1–2') long, 12 Mm. ( $\frac{1}{2}$ ') wide, ovate-lanceolate, obtuse at base, toothed, upper surface variegated (spotted) with white along midrib and veins; flowers purplish-white.

2. *Pyr'ola rotundifo'lia*, *Round-leaved Wintergreen*; *P. ellip'tica*, *Shin-leaf*, and *P. chloran'tha*, *Greenish-flowered Wintergreen*.—These three have racemes of nodding wax-like flowers; leaves resembling and containing same as the official, hence used similarly.

### 63. ERICACEÆ. Heath Family.

Er-i-ka'se-e. L. *Eric-a* + *aceæ*, Gr. ἐρεῖχη, heath, fr. ἐρεῖχω, to break —i. e., because some species break or dissolve stone in the bladder. Shrubs or small trees. Distinguished by astringent properties; leaves evergreen, exstipulate; calyx 4–5-cleft, inferior, corolla regular, hypogynous, 4–5-cleft; stamens as many or twice corolla-lobes, free from but inserted with corolla; anthers 2-celled; ovary 2–5-celled, style 1;

**ERICACEÆ.**

fruit, capsule, or berry, edible; universal; astringent, tonic, diuretic, narcotic, poisonous.

Genera: 1. *Gaultheria*. 2. *Arctostaphylos*.

**GAULTHERIA. GAULTHERIA.**

**Oleum Gaultheriæ.** Oil of *Gaultheria*, *official*.

**Gaultheria procumbens**, *Linné*. } A volatile oil, distilled from the leaves, rectified, if necessary, by steam distillation.

*Habitat.* N. America, Canada, Georgia, Minnesota, in cold, damp woods, mostly in the shade of evergreens.

*Syn.* Wintergreen, Spring-, Creeping-, Spicy or Aromatic Wintergreen, Checker, Partridge-, Box-, Spice-, Deer-, Tea-, Ground-, Grouse-, Red or Hill-berry, Wax Cluster, Mountain Tea, Chinks, Red Pollom, Ivory Plum, Oil of Wintergreen, Oil of Teaberry or Partridge-berry; Fr. Feuilles de Gaulthérie (de Palommier), Thé (du Canada) de Terre-neuve, Essence de Gaulthérie; Ger. Canadischer Thee, Bergthee, Bergtheeöl.

**Gaul-the'ri-a.** L. dedicated by Kalm to Dr. Gaulther, of Quebec.

**Pro-cum'bens.** L. *pro*, forward, + *cumbere*, to lie, lying down—i. e., the stem.

**PLANT.**—Stem creeping on or below the surface, branches ascending; leaves alternate, evergreen, spicy, obovate, mucronate, serrate,

FIG. 297.

*Gaultheria procumbens.*

crowded at top of the stem; flowers June–Sept., few, white, on stem 7.5–12.5 Cm. (3–5') high; fruit, bright red berries or capsules, 5-celled, spicy, aromatic.

**CONSTITUENTS.**—Volatile oil 0.5 p. c. (salicylic acid, methyl salicylate), arbutin, ericolin, urson, resins, tannin 6 p. c., ash 4–5 p. c.

**Oleum Gaultheriæ.** Oil of *Gaultheria*.—This is a colorless or

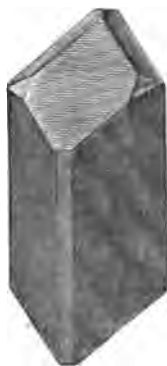
yellowish liquid; characteristic aromatic odor; sweet, warm, aromatic taste; sp. gr. 1.180; consists of methyl salicylate,  $\text{CH}_3\text{C}_7\text{H}_5\text{O}_2$ , 99 p. c., also a paraffin (triacontan),  $\text{C}_{30}\text{H}_{62}$ , an aldehyde or ketone, an apparently secondary alcohol,  $\text{C}_8\text{H}_{16}\text{O}$ , and an ester,  $\text{C}_{14}\text{H}_{24}\text{O}_2$ ; it is soluble in alcohol, giving with ferric chloride in alcoholic solution dark purple; with nitric acid forms colorless prisms. *Tests*: 1. Heated to  $80^\circ\text{C}$ . ( $176^\circ\text{F}$ .) should not give colorless distillate (abs. of alcohol, chloroform). 2. Equal quantity nitric acid should not give deep red color or dark red resinous mass (abs. of sassafras oil). 3. Sulphuric acid increases temperature, owing to terpene present (not so with artificial oil). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{Mj}$ –10 (.06–.6 Cc.).

**ADULTERATIONS.**—Sassafras and betula oils, alcohol, chloroform, etc.

**Acidum Salicylicum.** Salicylic Acid,  $\text{HC}_7\text{H}_5\text{O}_2$ , *official*.—(Syn., Ortho-oxybenzoic Acid; Fr. Acide salicylique; Ger. Salicylsäure.)

This monobasic organic acid exists naturally in combination in various plants (gaultheria, betula, etc.), and may be obtained by fusing salicin with potassium hydroxide, or by heating (saponification) oil of gaultheria with potassium hydroxide until all of the methyl alcohol is given off, then decomposing the potassium salicylate with hydrochloric acid; it is prepared synthetically, on a much larger scale, by saturating phenol with sodium hydroxide, thereby producing sodium phenolate, which, when dry, is put into a retort, and through it, heated gradually ( $100$ – $220^\circ\text{C}$ .;  $212$ – $428^\circ\text{F}$ .), is passed dry carbon dioxide, this entering the phenol molecule producing disodium salicylate, while one-half of the phenol distils over— $2\text{C}_6\text{H}_5\text{ONa} + \text{CO}_2 = \text{C}_6\text{H}_4\text{ONaCO}_2\text{Na} + \text{C}_6\text{H}_5\text{OH}$ ; dissolve residue of retort in boiling water, filter, decompose by hydrochloric acid, when cool impure salicylic acid

FIG. 298.



Salicylic acid crystal.

crystallizes out, sodium chloride remaining in solution— $\text{Na}_2\text{C}_7\text{H}_5\text{O}_2 + 2\text{HCl} = 2\text{NaCl} + \text{C}_7\text{H}_5\text{OHCO}_2\text{H}$ ; to purify, neutralize with calcium carbonate, decompose with hydrochloric acid, or sublime in a current of superheated steam. It is in light, fine, white, prismatic needles, or bulky, crystalline powder; odorless, or slightly gaultheria-like, sweetish, acid taste, permanent; soluble in ether, chloroform, 2 parts of alcohol, 308 water; melts at  $157^\circ\text{C}$ . ( $315^\circ\text{F}$ .), at higher temperature dissipates leaving 0.6 p. c. residue; 138 grains salicylic acid correspond to 169 grains oil of gaultheria. *Tests*: 1. Aqueous or alcoholic solution turns bluish-violet with ferric chloride T. S. 2. Small portion heated to boiling with 1 Cc. each sulphuric acid and methyl alcohol, gives methyl salicylate, recognized by its odor. *Impurities*: Iron, phenol, hydrochloric acid, coloring matter, readily carbonizable, organic substances. Dose, gr. 5–20 (.3–1.3 Gm.).

**Methylis Salicylas.** Methyl Salicylate,  $\text{CH}_3\text{C}_7\text{H}_5\text{O}_2$ , *official*.—(Syn., Methyl Salicylas, U. S. P. 1890, Artificial (Synthetic) Oil of Wintergreen; Fr. Salicylate de Methyl; Ger. Künstliches Wintergrünöl.)

**ERICACEÆ.**

This ester is produced synthetically by distilling salicylic acid or a salicylate with methyl alcohol and sulphuric acid, when methyl salicylate distils over— $\text{HC}_7\text{H}_5\text{O}_3 + \text{CH}_3\text{OH} + \text{H}_2\text{SO}_4 = \text{CH}_3\text{C}_7\text{H}_5\text{O}_3 + \text{H}_2\text{O} + \text{H}_2\text{SO}_4$ . It is a colorless liquid, characteristic, strongly aromatic, wintergreen odor, sweetish, warm, aromatic taste, being the principle constituent of oil of gaultheria and oil of betula, sp. gr. 1.185, boils at  $220^\circ \text{C}$ . ( $428^\circ \text{F}$ .), soluble in alcohol, glacial acetic acid, carbon disulphide, sparingly in water. *Tests*: 1. Agitate 1 Cc. with 10 potassium hydroxide T. S., get bulky, white, crystalline precipitate, which dissolves upon being placed in boiling water 5 minutes with occasional shaking, yielding clear, colorless, or faintly yellowish solution, without separation of oily drops on surface or at bottom (abs. of volatile oils, petroleum); this alkaline solution, + 3 volumes water, + excess hydrochloric acid gives white, crystalline precipitate of salicylic acid (abs. of methyl benzoate, etc.). 2. When distilled, the distillate should not have characteristics of alcohol or chloroform. Dose, m̄j–10 (.06–.6 Cc.).

*Impurities*: Alcohol, chloroform, volatile oils, petroleum, methyl benzoate.

**PREPARATIONS.**—I. OIL: 1. *Spiritus Gaultheriæ*. Spirit of Gaultheria. (Syn., Fr. Alcoolat (Esprit) de Gaulthérie; Ger. Bergtheespiritus (geist).)

*Manufacture*: 5 p. c. Dissolve oil 5 Cc. in alcohol 95 Cc. Dose, ʒj–2 (4–8 Cc.).

2. *Emulsum Olei Morrhuæ*,  $\frac{2}{5}$  p. c. 3. *Emulsum Olei Morrhuæ cum Hypophosphitibus*,  $\frac{2}{5}$  p. c. 4. *Liquor Antisepticus*,  $\frac{1}{10}$  p. c. 5. *Syrupus Sarsaparillæ Compositus*,  $\frac{1}{50}$  p. c.

II. METHYL SALICYLATE: 1. *Cataplasma Kaolini*,  $\frac{1}{2}$  p. c.

*Unoff. Prep.*: *Unguentum Acidi Salicylici* (Br.), 2 p. c.

**PROPERTIES.**—Antiseptic, antipyretic, antiperiodic, stimulant, diuretic, cardiac depressant. Small doses stimulate the stomach, heart, respiration; large doses derange stomach, causing nausea, vomiting, reduce respiration, heart action, temperature, and arterial tension. By gastro-intestinal secretions converted into sodium salicylate, and as such enters circulation; it is eliminated by kidneys and skin mainly as salicyluric acid.

**USES.**—Rheumatic fever, migraine, sciatica, diabetes, cystitis, diphtheria; externally—warts, corns, excess of epidermis.

*Salicylism* is the result of excessive doses of salicylates, and resembles *cinchonism* from quinine. It is manifested by headache, deafness, ringing in the ears, sweating, weak pulse and respiration, nausea, delirium, vomiting, etc., and can be prevented by preceding each dose with a small quantity of alcoholic stimulant.

*Poisoning*: Give emetics, diffusible stimulants, atropine, strychnine, artificial heat. Same as for acetanilide.

*Incompatibles*: Arterial and cerebral stimulants: alkalies, mineral acids, metallic salts (especially ferrie), spirit of nitrous ether.

*Synergists*: Phenol (carbolic acid) derivatives, anæsthetics, cardiac and cerebral depressants.

Leaves of gaultheria, official 1820–1890.



RECAPITULATION No. 7.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanical source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Mitracae:</i> 1. <i>Gossypii</i> Cortex. 2. Cotton Root Bark.	<i>Gossypium</i> herba- ceum, +.	The dried bark of the root. The hairs of the seed.	Asia, Africa (United States).	Chromogene, resin, fixed oil, Cellulose, fixed oil, inorganics.	Pyroxilin, collo- dion, styptic, flexible and can- tharidal collo- dions.	Emmenagogue, oxytocic.  Protective.	Dysmenorrhoea, amen- orrhoea, etc.  Dressing to burns, surgical wounds, etc.	Grains. 30-60 (2-4 Gm.).
1. <i>Gossypium</i> Puri- ficatum. 2. Purified Cotton.								
1. <i>Oleum</i> <i>Gossypii</i> Seminis. 2. Cotton Seed Oil.		The fixed oil.		Olein, palmitin.	Lin. ammon., lin. camph.	Demulcent, nutri- tive.	For olive oil, lini- ments.	Minims. 120-480 (8-30 Cc.).
<i>Sterculiaceae:</i> 1. <i>Oleum</i> Theobro- matis. 2. Oil of Theobroma	Theobroma Cacao.	The fixed oil.	S. America.	Stearin, palmitin, laurin, olein, gly- cerides of formic, acetic, butyric acids.		Demulcent, nutri- ent.	Abraded surfaces, base for suppositories, ointments.	Grains. 30-60 (2-4 Gm.).
<i>Theaceae</i> , see <i>Rubiaceae</i> .	<i>Thea chinensis</i> .							
<i>Guttiferæ:</i> 1. <i>Cambugia</i> . 2. <i>Gamboge</i> .	<i>Garcinia</i> Hanburii.	The gum- resin.	Camboja, Annam, Siam.	Gum, resin (cambogic acid).	Pil. cathar. comp.	Drastic, hydra- gogue cathartic.	Liver and kidney diseases, verminage, dropsy.	$\frac{1}{2}$ -5 (.05-3 Gm.).
<i>Thymelæaceae:</i> 1. <i>Mezereum</i> . 2. <i>Mezereum</i> .	<i>Daphne</i> Meze- reum.	The dried bark.	Europe.	Daphnin, resin, vola- tile oil.	Fluidextr., fluid- extr. sars. co.	Stimulant, diure- tic, diaphoretic, alterative, siala- gogue, vesicant.	Syphilis, scrofula, rheumatism, skin diseases.	1-10 (.06-6 Gm.).
<i>Lythraceæ:</i> 1. <i>Granatum</i> . 2. <i>Pomegranate</i> .	<i>Punica</i> Granatum.	The bark of the stem and root.	S. W. Asia, India.	Punico-tannic acid, pelletierine, mannite gum, pectin.	Fluidextract, pel- letierine tan- nate.	Anthelmintic, tannifuge.	Tape- and lumbricoid worms.	30-120 (2-8 Gm.).
<i>Myrtaceæ:</i> 1. <i>Oleum</i> <i>Caluputi</i> . 2. Oil of <i>Caluput</i> .	<i>Melaleuca</i> Leuca- dendron.	The volatile oil.	E. India Islands.	Caluputol, hydrocar- bons, acetic, butyric, valerianic ethers of cetophenol.		Carminative, stimulant, diaphoretic, rubefacient.	Rheumatism, affections of stomach, bowels, colic, toothache, bron- chitis, dysmenorrhoea.	Minims. 2-10 (13-6 Cc.). Grains.
1. <i>Caryophyllus</i> . 2. <i>Cloves</i> .	<i>Eugenia</i> aro- matica.	The dried flower buds.	Molucca (Clove) Islands	Volatile oil, tannin, gum, resin, cary- ophyllin, eugenol.	Tinct. lavender. comp., tinct. rhei ar., vin. opii, Osl.	Stimulant, stom- achic, antispas- modic, rube- facient.	Nausea, colic, condi- ment, rheumatism, neuralgia, toothache.	4-10 (.5-6 Gm.).

1. <i>Pimenta</i> . 2. <i>Pimenta</i> .	<i>Pimenta officinalis</i> .	The dried, nearly ripe fruit.	C. and S. America.	Volatile oil, resin, fixed oil, tannin.	Oil.	Stomachic, stimulant, carminative, condiment.	Flatulence, nausea, colic, rheumatism, neuralgia.	5-30 (3-2 Gm.).
1. <i>Eucalyptus</i> . 2. <i>Eucalyptus</i> .	<i>Eucalyptus globulus</i> .	The dried leaves.	Australia.	Volatile oil, tannin, cerylic alcohol, fatty acid, resins.	Fluidextract, oil, eucalyptol.	Febrifuge, stimulant, astrigent, antiseptic, diaphoretic.	Intermittents, urinary troubles, bronchitis, hemorrhages, gleet, ulcers.	15-60 (1-4 Gm.).
<i>Umbelliferae</i> : 1. <i>Feniculum</i> . 2. <i>Fennel</i> .	<i>Feniculum vulgare</i> .	The dried fruit.	S. Europe, W. Asia.	Volatile oil, fixed oil, sugar, mucilage.	Comp. infus. sen- na, <i>Oil</i> : water, pulv. glycyrr. co., spt. junip. co.	Carminative, stimulant, galactagogue.	Nausea, colic, amenor- rhea, flatulence, in- creases secretions.	10-30 (6-2 Gm.).
1. <i>Anisum</i> . 2. <i>Anise</i> .	<i>Pimpinella Anisum</i> .	The ripe fruit.	W. Asia, S. Europe.	Volatile oil, fixed oil, sugar, mucilage.	<i>Oil</i> : water, spirit, spt. aurt. co., tr. syr. sars. co., tr. opi camph., troc. glycyrr. et opi. Tr. card. co., <i>Oil</i> : spt. junip. co.	Stimulant, carminative, aromatic.	Colic, flatulence, bron- chitis, catarrhs, fla- vorizing.	10-30 (6-2 Gm.).
1. <i>Carum</i> . 2. <i>Saraway</i> .	<i>Carum Carvi</i> ( <i>Carui</i> ).	The dried fruit.	C. and W. Asia.	Volatile oil, fixed oil, resin, sugar, gum, tannin.		Stimulant, carminative, diuretic.	Colic, flatulence, flavoring, toothache.	10-30 (6-2 Gm.).
1. <i>Coriandrum</i> . 2. <i>Coriander</i> .	<i>Coriandrum sativum</i> .	The dried ripe fruit.	C. Asia, S. Europe.	Volatile oil, tannin, malic acid, mucilage.	<i>Oil</i> : confec. sen- na, spt. aurt. co., syr. sennae.	Aromatic, carminative, stimulant, stomachic.	Indigestion, flatulence, flavoring, rheumatism.	10-30 (6-2 Gm.).
1. <i>Conium</i> . 2. <i>Conium</i> .	<i>Conium maculatum</i> .	The full-grown fruit.	Europe, Asia, N. Africa.	Conium, methylconi- ine, vol. oil, fixed oil, malic acid, con- hydrine.	Fluidextract.	Sedative, narcotic.	Chorea, mania, melan- cholia, tetanus, asthma, phthisis, etc.	1-5 (06-3 Gm.).
1. <i>Asafetida</i> . 2. <i>Asafetida</i> .	<i>Ferula fetida</i> .	The gum-resin.	Persia, Turkestan.	Gum, resin, volatile oil.	Emulsion, pill, tinct.	Stimulant, antispasmodic, laxative, emmenagogue.	Hysteria, spasms, asthma, catarrhs, chorea, consumption, flatul- ence.	3-10 (2-6 Gm.).
1. <i>Sumbul</i> . 2. <i>Sumbul</i> .	Undetermined plant.	The dried rhizome and root.	C. and N. Asia.	Volatile oil, resin, an- golic acid, valerianic acid.	Fluidextract, extract.	Stimulant, tonic, nervine, anti-spasmodic.	Hysteria, epilepsy, chlorosis, amenorrhoea, delirium tremens.	10-30 (6-2 Gm.).
<i>Pyrolacae</i> : 1. <i>Chimaphila</i> . 2. <i>Chimaphila</i> .	<i>Chimaphila umbellata</i> .	The dried leaves.	N. America.	Chimaphillin, arbutin, ercolin, urson, tan- nin, resin, sugar.	Fluidextract.	Astringent, tonic, diuretic, nephritic.	Serofula, rheumatism, dropsy, gravel, diar- rhea.	15-30 (1-4 Gm.).
<i>Eriogonae</i> : 1. <i>Oleum Gaultheriae</i> . 2. <i>Oil of Gaultheria</i> .	<i>Gaultheria procumbens</i> .	The volatile oil.	N. America.	Methyl salicylate, gaultherioline, ben- zoic ether.	Spt., syr. sars. co., salicylic acid, methyl salicy- late.	Antiseptic, antipyretic, antiperiodic, stimulant, diuretic.	Rheumatism, mi- graine, sciatica, di- abetes, cystitis, diph- theria, warts, corns.	Minims. (06-6 Cc.).

## UVA-URSI. UVA-URSI.

**Arctostaphylos**  
**Uva-Ursi**, (Linné) Sprengel. } The dried leaves.

*Habitat.* Europe, Asia, N. America; in mountains, on dry and rocky soil. United States, south of New Jersey, thence westward to California, New Mexico.

*Syn.* Bearberry, Upland, Mountain or Wild Cranberry, Universe Vine, Mountain Box, Bear's-Grape, Bilberry, or Whortleberry, Burren Myrtle, Kinni-Kinnick, Fox or Mealberry, Rapper Dandies (the fruit), Sagackhom; Br. *Uvæ Ursi Folia*; Fr. *Busserole*, Raisin d'Ours; Ger. *Folia Uvæ Ursi*, Bärentraubenblätter.

**Arc-to-staph'y-los.** L. fr. Gr. *ἄρκτος*, a bear, + *σταφυλή*, a bunch of grapes—i. e., the roughness of the fruit and these berries occurring in clusters like grapes.

**U'va-Ur'si.** L. *uva*, a grape, + *ursus*, *ursi*, a bear, of a bear—bear-berry—i. e., berries are rough or bearish.

**PLANT.**—Low evergreen shrub; stem trailing, young branches rising obliquely upward several inches; flowers May, 3–15 together, pinkish-white, racemes, calyx reddish, corolla urceolate, reddish-white or white with red lips; fruit autumn, 6 Mm. ( $\frac{1}{4}$ ') broad, fleshy, bright red berry, skin thick, 5-seeded, resembles currants in appearance and clusters. **LEAVES**, obovate or oblong-spatulate, 15–30 Mm. ( $\frac{3}{8}$ – $1\frac{1}{5}$ ') long, obtuse, slightly revolute on margin, tapering into a very short stout petiole, coriaceous, upper surface dark green, finely reticulate, lower surface slightly pubescent; odor slight; taste strongly astringent, somewhat bitter; collect in autumn. *Solvents*: diluted alcohol; boiling water. Dose, gr. 15–60 (1–4 Cc.).

**ADULTERATIONS.**—1. *Vaccinium Vitis-Idæa*, Wind or Cowberry, Red Whortleberry, and *V. uliginosum*, Bog Whortleberry, Great Bilberry. Leaves resemble uva-ursi, but margins crenate, under surface bristly, pubescent.

2. *Dendrium (Leiophyllum) buxifolium*, Sand Myrtle.—N. J. southward. Small shrub; leaves oval, shining, margin revolute, reticulate.

3. *Buxus semper-virens*, Box, Bush-tree Dudgeon.—Cultivated in gardens; leaves ovate, narrower toward apex than near the base; contain buxine and parabuxine (both giving bitterness), tannin, volatile oil, bitter extractive.

4. *Epigæa repens*, Trailing Arbutus (Mayflower, Ground Laurel, Gravel Plant), and *Chimaphila umbellata*, Pipsissewa.—Leaves resemble and both contain the three active constituents of uva-ursi. Used in lithic acid gravel. Dose, gr. 15–60 (1–4 Gm.).



*Arctostaphylos Uva-Ursi.*

**CONSTITUENTS.**—Arbutin,  $C_{12}H_{16}O_7$ , Ericolin,  $C_{34}H_{56}O_{22}$ , Urson,

**ERICACEÆ.**

$C_{10}H_{16}O$ , Tannin 6–7 p. c., gallic acid, ellagic acid, coloring matter, ash 3 p. c.

**Arbutin.**—A glucoside obtained by precipitating the decoction with lead subacetate, treating filtrate with hydrogen sulphide, and evaporating to crystallize. It is in needles, bitter, soluble in alcohol or hot water, insoluble in ether, blue with diluted ferric chloride; with sulphuric acid yields glucose, arctuin (hydroquinone),  $C_6H_6O_2$ , and methylhydroquinone,  $C_7H_8O_2$ . Dose, gr. 3–5 (.2–.3 Gm.).

FIG. 300.



*Arctostaphylos Uva-Ursi*: Piece of leaf epidermis (lower surface) showing large stomata.

**Ericolin.**—This is left in the mother-liquor from arbutin; it is a bitter glucoside, yellow, soluble in water, alcohol; yields glucose and ericinol (volatile oil).

**Urson.**—Crystalline principle, resinous, obtained by exhausting with ether, evaporating, recrystallizing from alcohol; occurs in tasteless needles, insoluble in water, sparingly in alcohol, ether.

FIG. 301.



*Arctostaphylos Uva-Ursi*: Bast fibres and parenchyma from part of leaf without chlorophyll, containing a single crystal.

**PREPARATIONS.**—1. *Extractum Uvæ-Ursi*. Extract of Uva-Ursi. (Syn., Fr. *Extrait de Busserole*; Ger. *Bärentraubenblätterextrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 30 p. c., q. s. Dose, gr. 5–15 (.3–1 Gm.).

2. *Fluidextractum Uvæ-Ursi*. Fluidextract of Uva-Ursi. (Syn., *Extractum Uvæ Ursi Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Bussérole*; Ger. *Flüssiges Bärentraubenblätterextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with glycerin 30 Cc., alcohol 20, water 50, finishing with alcohol 30 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv-60 (1-4 Cc.).

*Unoff. Preps.*: *Infusum Uvæ-Ursi* (Br.), 5 p. c., dose, ʒss-2 (15-60 Cc.). *Decoction*, dose, ʒj-2 (30-60 Cc.).

**PROPERTIES.**—Astringent, diuretic, nephritic, tonic, disinfectant (due to the hydroquinone formed). Large dose vomits, purges, oxytocic.

**USES.**—Cystitis, gravel, chronic nephritis, urethritis, incontinence of urine, dysuria, strangury, uterine hemorrhage, gleet, leucorrhœa, menorrhagia, urinary calculi, bronchitis, diarrhœa, cardiac dropsy.

*Allied Plants*:

1. *Arctostaphylos glauca*, *Manzanita*.—California mountains, small tree; leaves 5 Cm. (2') long; contains arbutin, tannin 10 p. c., ash 6 p. c. *A. polyfolia* and



*Palaquium Gutta*.

*A. mucronifera*, Mexico; both used like uva-ursi.

2. *Kalmia latifolia*, *Mountain Laurel*, *Calico-bush*.—1.8-9 M. (6-30°) high; flowers inodorous, May-June; leaves evergreen, elliptical; contain tannin, arbutin, resin, andromedotoxin,  $C_{31}H_{51}O_{10}$ . Astringent; large doses poisonous.

3. *Limonium carolinianum* (*Statice Limonium* var. *caroliniana*), *Marsh Rosemary*.—Plumbaginaceæ. The root, official 1820-1880. N. America. Plant a maritime perennial, acaulescent; leaves 2.5-4 Cm. (1-1½') long, obovate, cuneiform, entire, mucronate, scape .3-.6 M. (1-2°) high, terete, corymbose panicles; flowers lavender color; root .3-.6 M. (1-2°) long, 2.5 Cm. (1') thick, annulate, wrinkled, purplish-brown, astringent, bitter; contains tannin 14-18 p. c., volatile oil, resin. Used as astringent like catechu or kino for aphthous and ulcerative affections of the mouth, fauces, hemorrhages, dysentery; in infusion, decoction, tincture. Dose, gr. 5-30 (.3-2 Gm.).

4. *Palaquium Gutta*, and *P. oblongifolium*, *Gutta-Percha*—Sapotaceæ. Concrete exudation, official 1880-1890. Malayan Peninsula and islands, Singapore, Borneo. Tree, 18-21 M. (60-70°) high, .6-1 M. (2-3°) thick; bark reddish-gray; leaves 10-12.5 Cm. (4-5') long, tomentose, silky beneath; flowers yellowish. Gutta-percha is obtained by incisions, or by felling trees, removing bark, and catching juice in plantain-leaf stalks, palm leaves, or cocoanut shells; it soon coagulates and occurs in yellowish, grayish masses, hard, heavier than water, flexible, plastic at 50° C. (122° F.), decomposes on melting; inodorous; tasteless; soluble in ether, chloroform, oil of turpentine, carbon disulphide; contains gutta,  $C_{20}H_{32}$ , 80 p. c.,

**STYRACACEÆ.**

fine white powder; fluavil,  $C_{20}H_{32}O$ , yellow resin; albane,  $C_{20}H_{32}O_2$ , white resin. Used in surgery for splints, catheters, bougies, specula, pessaries, syringes, etc. *Liquor Gutta-Perchæ*, official 1880–1890, = 9 p. c. solution in chloroform. Used as an adhesive and protective agent for wounds, abrasions, skin affections, sore nipples, erysipelas, smallpox, etc.

5. *Diospyros virginiana*, *Persimmon*.—Ebenaceæ. The unripe fruit dried, official 1820–1880. United States. Tree, 6–21 M. (20–70°) high, much smaller northward; wood hard, blackish; leaves 7.5–12.5 Cm. (3–5') long, entire, glaucous beneath, elliptical; flowers yellowish; fruit plum-like, 2.5 Cm. (1') thick, green, 4-lobed calyx at base; short style at apex, 6-celled, 6-seeded; taste astringent, when ripe orange-red, by frost sweet, edible; contains tannin, malic acid. Used as astringent for diarrhœa, chronic dysentery, uterine hemorrhage, leucorrhœa, sore throat; in infusion, tincture, syrup. Dose, gr. 15–60 (1–4 Gm.). Persimmon beer, made by fermenting ripe fruit with hops, as a beverage, and the bark as tonic and astringent, are popular to some extent.

**64. STYRACACEÆ. Storax Family.**

Sti-ra-ka'se-e. L. *Styr-ax*(ac) + acæ, Gr. *στόραξ*, a tree yielding gum, an alteration of native Ar. name *Assthirak*. Trees, shrubs. Distinguished by yielding stimulant balsamic resins; calyx 4–8-cleft, inferior; corolla 4–8-lobed; stamens equal or twice the petals, united at base; ovary 2–5-celled, each 1-seeded, style 1; fruit, berry or drupe, fleshy; tropics, temperate climates; stimulant; resins, dyes.

Genus: 1. *Styrax*.

**BENZOINUM. BENZOIN.**

*Styrax Benzoin*, *Dryander*, } A balsamic resin.  
and another unidentified species. }

*Habitat*. Sumatra, Java, Borneo, Malay Peninsula, Laos, Siam; cultivated.

*Syn*. Benzoin Laurel, Benjamin Tree, Resina Benzoe, Asa Dulcis, Gum Benjamin; Fr. Benjoin (de Sumatra); Ger. Benzoë, Benzoe.

*Styrax*. L. see etymology, above, of Styracaceæ.

*Ben-zo-i-num*. L. fr. Ar. *luban, java*, = *lu* + *ban* + *join*, contracted, lit., "incense of Java," in universal use.

*Ben-zo'in*. The original word and mostly used.

**PLANT**.—Handsome tree, medium height, with dense spreading crown; bark grayish, tomentose; leaves oblong, downy, 7.5–12.5 Cm. (3–5') long, acuminate, dentate; flowers inside reddish, outside white, hairy, anthers 2-celled. Grows upon interior hills and seacoast plantations. **BALSAMIC RESIN** (benzoin), in pebble-like bodies or tears, mostly 0.5–5 Cm. ( $\frac{1}{5}$ –2') long, one-fourth as thick, slightly flattened or curved, yellowish- to rusty-brown, milky-white on fresh fracture, separate or slightly agglutinated (Siam), or imbedded in dry resinous mass, reddish- to grayish-brown, opaque or slightly translucent and lustrous (Sumatra), brittle, soft on warming, yielding benzoic acid on sublimation, soluble in 5 parts warm alcohol giving acid reaction, in

solutions sodium or potassium hydroxide; odor agreeable, balsamic (Siam, vanilla-like); taste slightly acid. *Test*: 1. Boiled with milk of lime, the hot filtrate + potassium permanganate T. S. should not give odor of bitter-almond oil (abs. of cinnamic acid). Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—Wood, barks, etc. (in cake benzoin), but these remain behind when treated with alcohol or sublimed, 10–40 p. c.

**Commercial.**—The resin is collected from wild and cultivated trees when 5–6 years old, and trunk 15–20 Cm. (6–8') thick. In July–

Nov. longitudinal or oblique incisions are made through the bark between the ground and its first branches, into which the white liquid resin slowly exudes—a tannate transformation resulting from wounding; after 3 months, when dry and hard (concreted) it is picked up, cut or scraped off with knives or sharp sticks, collected in baskets, assorted according to sizes, cleanness and quality, the larger (tears, marbles, almonds) bringing the higher price. Only unhealthy trees yield the resin, and as it is a pathologic result, they contain no resin-receptacles; each tree yields annually about 3 pounds (1.5 Kg.) for 12 years, when they are cut down; the first 3 years' product is best (fuller of white tears, most fragrant), being called natively *head benzoin*; the next 7–8 years' yield contains less white



*Styrax Benzoin*: 1, flowering twig; 2, vertical section of flower; 3, diagram of the flower; 4, fruit, with upper portion laid bare, showing channelled surface; 5, anther; 6, seed, longitudinal section.

tears, is browner—*belly benzoin*; after trees are felled and stems split, an inferior quality is scraped off, which is dark, mixed with wood, bark, and other impurities—*foot benzoin*. These variety names correspond to our *superior*, *medium*, *inferior*, having their relative values, 105, 45, 18. It is received at the Sumatra ports in cakes wrapped in matting; here it is softened by heat, packed in chests, and sent to Penang and Singapore, thence into commerce; in Siam it is conveyed on bullocks' backs to Menam River, thence into market in cubical blocks, via Bangkok. We have several varieties:

1. *Sumatra, Penang*.—This is grayish-brown, with many white tears, by age reddish-brown, partly soluble in carbon disulphide; odor weak, storax-like; inferior kinds have few or no tears, but many chips of wood, bark, etc.

2. *Siam*.—Considered best, reddish-brown, in large or small tears, soluble in carbon disulphide; odor strongest, most agreeable, vanilla-like; taste bitter. Occurs in two forms: (a) tears or lumps, (b) amygdaloid. The tears are almond-shaped, often 2.5 Cm. (1') long, more or less flattened; when these become agglutinated with a reddish-brown substance we have the amygdaloid.

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3. *Palembang*.—This resembles Sumatra, but is somewhat more transparent, and is said to yield a greater percentage of benzoic acid.

4. *False Benzoin, Catappa Benzoin (Bu'ceras (Termina'lia) angustifolius—Combretaceæ)*.—This is whitish-brown, being obtained by incisions. The quality depends, in all these varieties, upon the amount of tears, but the Siam is the best flavored.

CONSTITUENTS.—Siam: Benzoic acid 10–20 p. c., Cinnamic acid, Resius, Vanillin 0.1–1.5 p. c., volatile oil (benzoic acid ester—aromatic, neutral) 0.3 p. c., 2 esters—benzoresinol benzoate,  $C_{16}H_{26}O_2$ , 5 p. c. (in long white prisms), and resinotannol benzoate,  $C_{12}H_{14}O_3$ , 57 p. c., ash 0.5–2.38 p. c.; Sumatra also has styracin 0.1–1 p. c., styrol, benzaldehyde, phenyl-propyl cinnamate 1 p. c.—the 2 esters being 75 p. c. (of which 92 p. c. is resinotannol, 7.4 p. c. benzoresinol) yield cinnamic acid 33 p. c.

**Acidum Benzoicum.** Benzoic Acid,  $HC_7H_5O_2$ , *official*.—(Syn., Acidum Benzoicum Sublimatum, Flores Benzoes, Flowers of Benzoin; Fr. Acide benzoïque, Fleurs de Banjoin; Ger. Benzoesäure, Benzoeblumen.) It is an organic acid which may be obtained by (*wet process*) boiling benzoin several hours with milk of lime, filtering while hot; supersaturate filtrate with hydrochloric acid, allow to crystallize, purify; more frequently prepared by the (*dry process*) sublimation of benzoin (sometimes having an equal weight of sand added) between the temperatures 140–180° C. (284–366° F.). It is made also from hippuric acid (horse and cattle urine, furnishing the *German benzoic acid*), as well as synthetically from phthalic acid (naphthalene), but for commercial purposes it is prepared chiefly artificially from toluene (toluol),  $C_6H_5CH_3$ , by passing chlorine into it (boiling) until ceasing to gain weight, thereby converting it first into benzo-trichloride, and then treating this with water under pressure— $C_6H_5CCl_3 + 2H_2O = C_6H_5COOH + 3HCl$ ; it occurs in white or yellowish lustrous scales or friable needles; slight odor of benzoin; warm, acid taste, partially volatile at warm temperature, sublimates at 100° C. (212° F.), melts at 121.4° C. (250.5° F.), at higher temperature is consumed, leaving no residue; becomes yellow on exposure to light; soluble in 281 parts water, 1.8 alcohol, 3 ether, 7 chloroform, carbon disulphide, benzene, fixed and volatile oils—the sublimed is most soluble in water. *Tests*: 1. Heat gradually with 3 parts slaked lime get benzene evolved. 2. Heat 0.5 Gm. to 45° C. (113° F.) with 5 Cc. water + 0.5 Gm. potassium permanganate in stoppered test-tube, upon cooling should not get odor of oil of bitter-almond (abs. of cinnamic acid). *Impurities*: Chlorine, cinnamic acid, readily carbonizable, organic matters. The U. S. P. recognizes the sublimed and synthetic varieties. Should be kept cool, in well-stoppered, dark amber-colored bottles. Dose, gr. 5–15 (.3–1 Gm.).

**Cinnamic Acid,  $C_9H_7O_2$** .—Obtained by agitating filtered ethereal solution with weak sodium hydroxide solution (to remove benzoic acid and vanillin), distilling off ether, saponifying pure esters by boiling with sodium hydroxide solution several hours, acidifying, boiling, filtering, cooling, when crystals appear. The two acids may be separated by their different degree of volatility, benzoic acid melting at 121.4° C. (250.5° F.) and the two mixed (1 cinnamic, 2 benzoic) at 25.5° C. (78° F.).



**Resins.**—One is extracted along with benzoic acid by boiling solution of potassium carbonate in excess; another is dissolved from the residue by ether, while the third is affected by neither solvent, hence left as a residue. With melted potassium hydroxide get paroxybenzoic acid,  $C_7H_5O_3$ , protocatechuic acid,  $C_7H_5O_4$ , and pyrocatechin,  $C_6H_6O_2$ .

**Vanillin**,  $C_8H_8O_3$ .—Is obtained by treating Siam benzoin with caustic lime, precipitating benzoic acid with hydrochloric acid and shaking liquid with ether.

**PREPARATIONS.**—I. **BENZOIN**: 1 *Adeps Benzoinatus*. Benzoinated Lard. (Syn., Benzoated Lard, Unguentum Benzoini, Axungia Balsamica—Benzoinata or Benzoata; Br. Adeps Benzoatus; Fr. Axonge (Graissee) benzoinée (balsamique); Ger. Benzoe (Benzoinirtes)-schmalz.)

*Manufacture*: 2 p. c. Mix thoroughly 2 Gm., in coarse powder, with lard 100 Gm., heat gently on water-bath 2 hours, stirring frequently, strain, stir while cooling. When for hot-weather use, may replace 5 p. c. (or more) of the lard by white wax.

*Preps.*: 1. *Ceratum*, 50 p. c. 2. *Ceratum Camphoræ*, 40 p. c. 3. *Unguentum*, 80 p. c. 4. *Unguentum Belladonnæ*, 65 p. c. 5. *Unguentum Chrysarobini*, 95 p. c. 6. *Unguentum Hydrargyri*, 25 p. c. 7. *Unguentum Iodi*, 80 p. c. 8. *Unguentum Potassii Iodidi*, 80 p. c. 9. *Unguentum Stramonii*, 65 p. c. 10. *Unguentum Sulphuris*, 85 p. c. 11. *Unguentum Veratrinæ*, 90 p. c. 12. *Unguentum Zinci Oxidi*, 80 p. c.

2. *Tinctura Benzoini*. Tincture of Benzoin. (Syn., Fr. Teinture de Benjoin; Ger. Benzoëtinktur.)

*Manufacture*: 20 p. c. Triturate 20 Gm. with alcohol 25 Cc. to uniform magma, macerate 3 days, frequently agitating, with alcohol q. s. 100 Cc., filter. Dose, ʒss–1 (2–4 Cc.); largely externally.

3. *Tinctura Benzoini Composita*. Compound Tincture of Benzoin. (Syn., Friar's or Turlington's Balsam, Tinctura Balsamica, Balsamum Commendatoris, Elixir Traumaticum; Fr. Teinture balsamique, Baume du Commandeur de Permes; Ger. Persischer Wundbalsam.)

*Manufacture*: 10 p. c. Triturate benzoin 10 Gm., purified aloes 2, with alcohol 25 Cc. to uniform magma, add storax 8 Gm., balsam of tolu 4, macerate 3 days, frequently agitating, filter, add alcohol q. s. 100 Cc. Dose, ʒss–1 (2–4 Cc.); mostly externally.

II. **BENZOIC ACID**: 1. *Tinctura Opii Camphorata*,  $\frac{2}{3}$  p. c. 2. *Liquor Antisepticus*,  $\frac{1}{10}$  p. c.

*Unoff. Prep.*: *Trochiscus Acidi Benzoici* (Br.), each contains  $\frac{1}{2}$  gr. (.03 Gm.).

**PROPERTIES.**—Stimulant, expectorant, antiseptic, diuretic, antipyretic. It is eliminated slightly by the skin, salivary glands, and broncho-pulmonary mucous membrane, but mostly by the kidneys, where it is converted into hippuric acid, which renders alkaline urine acid, increases the flow, disinfects and stimulates the genito-urinary tract.

**USES.**—Chronic laryngitis, diarrhoea, dysentery. Locally the tincture as a stimulant and protective to wounds, to arrest coryza. Benzoic acid—for bronchitis, uric acid deposits, cystitis, acute gonorrhoea, phos-

**OLEACEÆ.**

phatic gravel, incontinence of urine, rheumatism, Bright's disease, albuminuria, dressing to wounds, ulcers.

*Incompatibles:* The tinctures with all aqueous preparations.

**65. OLEACEÆ. Olive Family.**

O-le-a'se-e. L. *Ole-a* + aceæ, Gr. *ἐλαία*, olive tree, *ἐλαον*, *oleum*, oil—*i. e.*, referring to the oleaginous fruit. Trees or shrubs. Distinguished by stamens 2–4, inserted on corolla; ovary 2-celled, superior; ovules 2 in each cell; calyx and corolla 4–8-cleft, regular; fruit capsule, samara, berry or drupe, often 1-seeded; temperate climates, tropics; tonic, febrifuge, purgative, perfumery (vol. oil), fragrant flowers; hardwood, dye.

Genera: 1. *Olea*. 2. *Fraxinus*.

**OLEA. OLIVE.**

*Oleum Olivæ. Olive Oil, official.*

*Olea europæa*, Linné. } A fixed oil, expressed from the ripe fruit.

*Habitat.* Asia, S. Europe (Spain, Portugal, Asia Minor, Syria, Italy, S. France), Algeria; cultivated in S. United States (Fla., Cal.), S. America.

*Syn.* Olive Gum, Lucca Gum, Olive (Bark) Leaves, Sweet Oil; Fr. Huile d'Olive; Ger. *Oleum Olivarum*, *Olivenöl*.

*O'le-a.* L. olive, fr. Gr. *ἐλαία*, olive tree, *oliva*, the fruit, *oleum*, the juice or oil from the fruit.

*Eu-ro-pæ'a.* L. European—*i. e.*, its habitat.

**PLANT.**—When wild a branched, thorny shrub; under cultivation a tree 3–9 M. (10–30°) high, resembling white willow; bark grayish-white; leaves 5–6 Cm. (2–2½') long, lanceolate, acute, entire, coriaceous, glabrous, upper side glaucous-green, the lower silvery-white; flowers many, small, creamy-white, diandrous, racemes; fruit drupe, 12–25 Mm. (½–1') long, ovoid, pointed, olive-green then deep purple, sarcocarp firm, fleshy, internally greenish and filled with oil; stone (putamen) thick, bony, ovoid, 1-seeded.

**CONSTITUENTS.**—**FRUIT SARCOCARP:** Fixed oil 70 p. c., water 25 p. c.

**Oleum Olivæ. Olive Oil.**—Pale yellow, oily liquid; slight odor; nutty, oleaginous taste, afterward faintly acrid; sp. gr. 0.915; soluble in ether, chloroform, carbon disulphide; at 0° C. (32° F.) forms a whitish, granular mass; contains olein 70 p. c., linolein 6 p. c., palmitin and arachin 28 p. c., phytosterin (unsaponifiable matter, once considered to be cholesterin), chlorophyll (from fruit, imparting greenish color). *Tests:* 1. Oil 2 Cc. shaken with 2 Cc. nitric acid, should retain light yellow color, not

FIG. 304.



becoming orange or reddish-brown; in 6 hours should change to yellowish-white solid mass and almost colorless liquid (abs. of cottonseed oil, most other seed oils). 2. Oil 5 Cc. shaken with 5 Cc. alcoholic solution silver nitrate (0.1 Gm. + 10 Cc. alcohol + 2 drops nitric acid), heated, should retain pale color, not become reddish or brown, nor be dark at line of contact (abs. of more than 5 p. c. cottonseed oil). 3. Oil 2 Cc. + 1 Cc. hydrochloric acid containing 1 p. c. sugar, shake, let stand, + 3 Cc. water, shake—acid layer should not show pink color (abs. of sesame oil). The mixed fat acids, separated after saponification, melt at  $26.5^{\circ}\text{C}$ . ( $80^{\circ}\text{F}$ .), and begin to solidify at  $17.5^{\circ}\text{C}$ . ( $63.5^{\circ}\text{F}$ .). Should be kept cool, in well-stoppered bottles. Dose, adult,  $\text{ss}$ –1 (15–30 Cc.); infant,  $\text{zj}$ –2 (4–8 Cc.), in emulsion.

**ADULTERATIONS.**—Chiefly cottonseed oil, also ground-nut, poppy, rape, and sesame oils, etc., rarely less than 25 p. c.; all of these congeal at much lower temperature, and do not solidify when shaken with 12 parts mercuric nitrate, as does pure olive oil.

**Commercial.**—Tree has been grown successfully in California, but we depend solely upon foreign supply. Oil is obtained by crushing ripe fruit short of the putamen, and subjecting this marc, in coarse bags, to strong pressure; the oil is run into vessels containing water, from which it is skimmed after a few days' subsidence; this is the first grade or *virgin oil*. The pressed cake is taken from the bags, broken up finely with hot water, and again subjected to greater pressure, when both water and oil are expressed; the latter being drawn off from the surface to constitute *second-grade oil*. The remaining marc contains 9–12 p. c. oil, which can be extracted by carbon disulphide, or by mixing with hot water in cisterns (*enfer*), and allowing partial fermentation, thus yielding on the surface a disagreeably smelling oil, *huile d'enfer*. Sometimes inferior fruit is allowed to ferment in heaps or vats, giving by expression also an inferior oil, *huile fermentée*. In order to combine perfume, fineness, and sweetness, oil must be stored 6–8 months, until strong flavor has disappeared, and must be from fruit slightly ripe. The oil enters commerce in bottles, jugs, and barrels, under the brands: Provence, Florence, Gallipoli, Spanish, and Sicily; the best from S. France, but Italy furnishes one-half and Spain one-fifth of the entire output.

**PREPARATIONS.**—1. *Sapo*. Soap. (Syn., Sodium Oleate, White Castile Soap, Sapo Durus, Hard Soap; Fr. Savon Médicinæ, Savon blanc d'Espagne; Ger. Sapo medicatus—(*hispanicus*), Medizinische Seife, Seife, Spanische Seife.)

**Manufacture:** Olive oil and sodium hydroxide are boiled together until saponified,  $\text{C}_3\text{H}_5(\text{C}_{18}\text{H}_{33}\text{O}_2)_3 + 3\text{NaOH} = 3\text{NaC}_{18}\text{H}_{33}\text{O}_2$  (hard soap) +  $\text{C}_3\text{H}_5(\text{OH})_3$ . It is whitish, hard, solid, easily cut when fresh, faint, peculiar odor, free from rancidity, disagreeable alkaline taste and reaction, soluble in water, alcohol. **Impurities:** Water, animal fats, metals, sodium carbonate, silica, etc.

**Preps.:** 1. *Emplastrum Saponis*. Soap Plaster. (Syn., Fr. Emplastrum cum Sapone, Emplâtre de Savon; Ger. Emplastrum Saponatum, Seifenpflaster.)

## OLEACEÆ.

*Manufacture*: Rub soap 10 Gm. with enough water for a paste, mix with melted lead plaster 90 Gm., stir, evaporate to proper consistence.

2. *Linimentum Saponis*. Soap Liniment. (Syn., *Tinctura Saponis Camphorata*, Liquid Opodeldoc, Camphorated Tincture of Soap, *Spiritus Nervinus Camphoratus*; Fr. *Liniment savonneux camphré*; Ger. *Linimentum saponato-camphoratum*, (*Liquidum*) *Opodeldok*, *Flüssiger Opodeldok*.)

*Manufacture*: Heat soap 6 Gm. with boiling water 20 Cc., until clear gelatinous mass, mix with alcohol 50 Cc.; dissolve by agitation camphor 4.5 Gm., oil of rosemary 1 Cc. in alcohol 22.5 Cc., add this to warm soap mixture, add water q. s. 100 Cc., let stand, filter.

*Prep.*: 1. *Linimentum Chloroformi*, 70 p. c.

3. *Emplastrum Plumbi*. 4. *Extractum Colocynthis Compositum*, 14 p. c. 5. *Pilulæ Aloes*, 2 gr. (.13 Gm.). 6. *Pilulæ Asafætidæ*, 1 gr. (.06 Gm.). 7. *Pilulæ Opii*,  $\frac{1}{2}$  gr. (.02 Gm.).  
2. *Oleatum Atropinæ*, 50 p. c. 3. *Oleatum Cocainæ*, 50 p. c. 4. *Oleatum Veratrinæ*, 50 p. c. 5. *Unguentum Diachylon*, 49 p. c.

*Unoff. Preps.*: *Pilula Saponis Composita* (Br.), 60 p. c. + opium 20 p. c., dose, gr. 2–4 (.13–.26 Gm.). *Sapo Animalis* (Br.).

**PROPERTIES.**—Nutritious, demulcent, emollient, laxative, protection to mucous membrane against acrid or poisonous substances; it increases secretion of bile, peristalsis, and dissolves cholesterin, the chief constituent of gallstones. Like other oils, it is partly emulsified and saponified in the intestines, its glycerin being set free, and fatty acid combining with free alkalies to form soap, which with the emulsion forms molecular basis of the chyle. It enters the blood through the lacteals, being finally oxidized into  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . Soap has same properties.

**USES.**—Gallstones, cantharides and other poisoning, infantile constipation in enema. Externally—burns, skin inflammations, to protect from air, insect-bites, stings, bruises, sprains, wounds, engorged mammæ, rectal ascarides; facilitates removal of crusts, scales, etc., and introduction of bougies, catheters, pessaries, sounds, specula; to lubricate machinery, in making liniments, plasters, cerates, ointments, etc.

*Allied Products*:

1. *Olive Gum*, *Lecca Gum*; resinous substance which exudes spontaneously from the trees. 2. *Leaves* and *young bark*; used externally as astringents, antiseptics; internally as tonics in intermittents. 3. *Olive Wood*; has beautiful veins, pleasant odor, capable of fine polish, highly esteemed for backs of brushes, boxes, and in cabinet-work. 4. *Olive Fruit*; as a dessert—for this the unripe fruit is steeped repeatedly in water containing lime and ashes, then bottled in a slightly aromatic, concentrated salt solution; the small French or Provence and the large Spanish olives are used for this purpose.

MANNA. MANNA.

**Fraxinus**  
**Ornus**, Linné. } The concrete saccharine exudation.

*Habitat.* Mediterranean Basin, Asia Minor to Spain.

*Syn.* Manna (Flowering) Ash, European Manna Tree; Fr. Manne; Ger. Manna.

**Frax'i-nus.** L. for ash tree, fr. Gr. φράσσω—*fw*, to fence in, enclose—i. e., the wood is used for making hedges or fences, thus protecting things and places.

**Or'nus.** L. Wild Ash, fr. Heb. *oren*, Gr. ορείνος, classic name for wild mountain ash.

**Man'na.** L. fr. Gr. μάνα, Heb. *man*, Ar. *mann*, gift (of heaven) = divinely supplied food—i. e., to the Israelites in their journey through the wilderness of Arabia.

**PLANT.**—Small tree, 4.5–7.5 M. (15–25°) high; stem slender, bark gray, with leaf-scars on young twigs; leaves imparipinnate, 15–20 Cm.

FIG. 305.



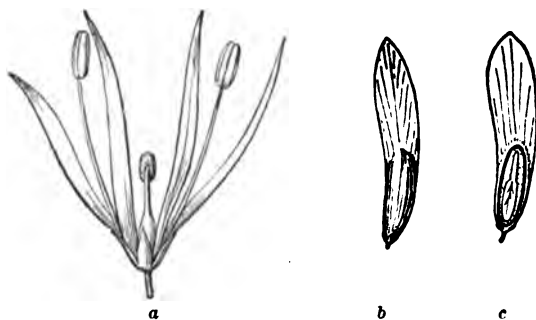
*Fraxinus Ornus*: branch showing leaves and flowers.

(6–8') long; leaflets 4 pairs, 2.5–5 Cm. (1–2') long, oval, acuminate, serrate, bright green, petiolate; flowers May–June, small, numerous, white, panicles, petals, 4 Mm. ( $\frac{1}{8}$ ') long; fruit samara, 2.5 Cm. (1') long, 4 Mm. ( $\frac{1}{8}$ ') wide. JUICE (manna), in flattish 3-edged pieces,

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occasionally 20 Cm. (8') long, 5 Cm. (2') broad, usually smaller; friable, yellowish-white; internally white, porous, crystalline, or in fragments of varying size, brownish-white, surface glutinous, inside white crystalline; odor suggestive of maple sugar; taste sweet, slightly bitter, acrid. Manna in brownish viscid masses, with few or no fragments of a crystalline structure, should be rejected. *Test*: 1. Manna 5 parts heated to boiling with alcohol 100 parts, the filtrate should quickly deposit mannite crystals. *Solvents*: hot or cold water; alcohol. *Dose*, 3j-8 (4-30 Gm.).

FIG. 306.



*Prazinus Ornus*: a, flower opened; b, single-winged fruit; c, longitudinal section of same.

**ADULTERATIONS.**—Products of allied species, bread crumbs, starch, glucose, wood, bark, etc.

**Commercial.**—The manna ash is so graceful as often to be planted in European gardens, yards, etc., for ornament, having been introduced in 1710. In Sicily whole plantations are cultivated for the juice, which is obtained from the trees when 8 years old, and stem 7.5-10 Cm. (3-4') thick, by cutting through the bark to the wood transverse incisions 2.5-5 Cm. (1-2') long, and 2.5 Cm. (1') apart, with a curved knife. The first cut is nearest the ground, and another is made directly above it every day during warm weather, July-Aug.; the next year the cutting is repeated on other portions of the stem, and so on yearly for 10-12 seasons, when, being spent, the trees are cut down and shoots allowed to spring from the stump. From these incisions manna exudes as a clear liquid, which soon concretes on the stem, or on sticks, straws, etc., placed in the incisions for that purpose. We have several varieties: 1. *Flake, Manna Cannulata*; obtained when juice is abundant, from upper incisions, which supply a product less fatty, consequently dries easily in tubes or flat pieces. 2. *Small, Tofa, Sorts, Manna Communis*, in tears, from lower incisions, into which leaves, etc., are placed for it to congeal upon; this is more gummy, sticky, less crystalline, inferior—some is scraped from the trees. 3. *Fat, Manna Pinguis*, in brown, viscid masses, non-crystalline; flows Oct.-Nov. down the trunk, full of impurities. Manna is dried upon shelves, packed for market in tin-lined deal boxes having partitions.

CONSTITUENTS.—Mannite 60–90 p. c., Glucose, mucilage, fraxin, resin.

**Mannite**  $C_6H_8(OH)_6$ .—Obtained with boiling alcohol and recrystallizing from the same several times; occurs in white prisms, soluble in 6.5 parts water, by oxidation gives fermentable mannitose and various acids.

**Glucose**.—Sometimes 16 p. c. **Mucilage and Fraxin**,  $C_{22}H_{36}O_{20}$ , are mostly in inferior grades; to this latter are due the fluorescence of the aqueous solution and the green color seen in some manna.

PREPARATIONS.—1. *Infusum Sennæ Compositum*, 12 p. c. Dose,  $\bar{3}j$ –3 (30–90 Cc.).

*Unoff. Prep.: Syrup.*

PROPERTIES.—Laxative, demulcent, expectorant, cholagogue, may cause flatulence and colic; action slow and constrictes secondarily.

USES.—Usually given with other medicines, as senna, rhubarb, magnesium oxide, neutral salts, etc., to which it adds purgative properties, and by its sweetness disguises disagreeable taste of its associate. Useful in piles, genito-urinary irritation, constipation of pregnancy. Mostly given to children and delicate persons, for whom its sweetness peculiarly adapts it.

*Allied Products:*

1. *Fraxinus excel'sior*, *European Ash*.—S. Europe. Produces manna identical with the official.

2. *La'rix Larix (europæa)*, *Briançon Manna* (Pinacæ); *Quercus Vallo'nea*, *Armenian Manna* (Fagacæ); *Alha'gi camelo'rum*, *Persian Manna* (Papilionacæ); *Eucalyptus gonioca'lyz*, *E. Gun'ni* and *E. vimina'lis* (Myrtacæ); *Tam'arix mannif'era*, *Tamarisk Manna* (Tamaricacæ). All these produce sweet exudations or mannas (not met in commerce), containing melezitose,  $C_{12}H_{22}O_{11} \cdot 3H_2O$ , or melitose,  $C_{12}H_{22}O_{11}$ , or some such saccharine principle. The saccharine products of some insects as *Trehala*, cocoon of *Lavi'nus mellif'icus* (Syria) and *Lerp*, upon *Eucalyptus dumosa* (Australia) contain trehalose sugar, and are used as manna.

## 66. LOGANIACEÆ. Logania Family.

Lo-ga-ni-a'se-e. L. *Logani-a* + acæ, after J. Logan, a noted botanist. Shrubs, herbs, or trees. Distinguished by poisonous properties; leaves entire, stipulate or raised stipular line; calyx 4–5-cleft, inferior; corolla 4-, 5-, 10-cleft, regular; stamens epipetalous, 4, 5, 10; ovary 2-, 3-, 4-celled, superior; fruit capsule or drupe. Connects Gentianacæ, Apocynacæ, Scrophulariacæ (from which differentiated by having stipules), and Rubiacæ (which has no free ovary); tropics; nervine, tonic, anthelmintic, poisonous.

Genera: 1. *Gelsemium*. 2. *Spigelia*. 3. *Strychnos*.

## LOGANIACEÆ.

## GELSEMIUM. GELSEMIUM.

**Gelsemium**  
**sempervirens**, (Linné) Aiton filius. } The dried rhizome and roots.

*Habitat.* United States, southward, Va. to Fla., Ala.; rich, moist soil.

*Syn.* Yellow Jasmine, Wild or Carolina Jessamine, Woodbine, Evening Trumpet-flower; Br. Gelsemii Radix; Fr. Jasmin sauvage; Ger. Gelsemie, Giftjasmin, Gelber Jasmin.

**Gel-se'mi-um.** L. *gesmino*, *gelsomino*, jasmine, altered from *gelseminum*, a form of *jasminum*, all medieval names for the jasmynes (or jassamines), with which this was classed.

**Sem-per'vi-rens.** L. *semper*, always, + *vireu(t)s*, ppr. of *vivere*, to be green, ever-green—i. e., the leaves.

**PLANT.**—Beautiful climber, ascending large trees, forming festoons from one to another, and when in bloom delightfully perfuming the

FIG. 307.



*Gelsemium sempervirens*: a, rhizome; b, flowering branch; c, fruiting branch ('c', natural size); also flower, ovary, fruit, seed, floral diagram, enlarged.

surrounding atmosphere; stem twining, smooth, shining, hollow, purplish; leaves perennial, lanceolate, entire, dark green above, paler beneath; flowers Jan.—April, deep yellow, large; corolla funnel-shaped, 2.5–4 Cm. (1–1½') long, fragrant, poisonous; fruit flat, brown, capsule, 18 Mm. (¾') long, 2-celled, 4–6 winged seeds in each cell.



**RHIZOME**, cylindrical, 15 Cm. (6') long, usually in cut sections, 2.5 Cm. (1') long, 5–25 Mm. ( $\frac{1}{2}$ –1') thick, yellowish-brown with purplish-brown longitudinal lines, roots much thinner, few elongated, unbranched, coarsely hair-like, tough rootlets often attached; fracture of rhizome splintery, roots breaking with one-half the fracture transverse, the other half oblique or short-splintery; bark 1 Mm. ( $\frac{1}{25}$ ') thick, wood yellowish, porous, tough, many distinct medullary rays, in the rhizome eccentric, and with 4 groups of internal phloem; odor pronounced, characteristic; taste slightly aromatic, bitter. *Solvents*: diluted alcohol; water partially. Dose, gr. 2–10 (.13–.6 Gm.).

FIG. 308.



*Gelsemium sempervirens*: rhizome, transverse section.

**ADULTERATIONS**.—Aerial stem, recognized by its thinness, dark purplish color, thin corky layer, bast fibres in thick bundles close to cambium, destitute of alkaloid; roots of the tree Jasmine (*Jas'minum* (*Plumeri'a*) *ru'bra*), recognized by absence of indurated pith-cells, abundance of starch, 2-stemmed flowers.

**CONSTITUENTS**.—Alkaloids 0.2–0.5 p. c.: Gelsemine, Gelseminine, Gelsemic acid (Beta-methyl-æsculetin) 0.3–0.4 p. c., volatile oil 0.5 p. c., 2 resins 4 p. c., starch, gum, pectin.

**Gelsemine**,  $C_{49}H_{63}N_5O_{14}$ .—Obtained by adding acetic acid to concentrated tincture, precipitating resin with water; concentrate filtrate, remove gelsemic acid (?) with chloroform or ether, precipitate alkaloid with sodium carbonate, and extract it with chloroform, ether, or benzin. It is amorphous, white, very bitter, alkaline; with hydrochloric or nitric acid forms crystalline salts; with sulphuric acid + manganese dioxide get cherry-red, becoming olive-green. Dose, gr.  $\frac{1}{60}$ – $\frac{1}{20}$  (.001–.003 Gm.).

**Gelseminine**,  $C_{12}H_{14}NO_2$ .—Small, white, bitter crystals, soluble in alcohol, ether, chloroform, forms salts soluble in water (hydrochloride, nitrate, sulphate, etc.). Dose, gr.  $\frac{1}{120}$ – $\frac{1}{80}$  (.0005–.002 Gm.).

**Gelsemic (Gelseminic) Acid**,  $C_{13}H_{11}O_5$ .—A colorless, odorless, nearly tasteless crystalline body, once considered a glucoside, the same as æsculine,  $C_{15}H_{16}O_9$ ; while this is not true, it is identical with beta-methyl-æsculetin,  $C_9H_8(CH_3)O_4$ , found in scopolia, etc., soluble in hot alcohol, glacial acetic acid, alkalis with blue fluorescence—consequently is erroneously called gelsemic acid.

**PREPARATIONS**.—1. *Fluidextractum Gelsemii*. Fluidextract of Gelsemium. (Syn., Extractum Gelsemii Fluidum, U. S. P. 1890; Fr. Extrait liquide de Gelsemium; Ger. Flüssiges Gelsemiumextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose, Mij–10 (.13–.6 Cc.).

2. *Tinctura Gelsemii*. Tincture of Gelsemium. (Syn., Fr. Teinture de Gelsemium; Ger. Gelsemiumtinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with alcohol 65 p. c., q. s. 100 Cc. Dose, Mx–60 (.6–4 Cc.).

*Unoff. Preps.*: *Extract* (alcoholic), dose, gr.  $\frac{1}{2}$ –4 (.03–.26 Gm.). "Eclectic" resinoid, *gelsemin*, dose gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.).

## LOGANIACEÆ.

**PROPERTIES.**—Nervine, sedative, mydriatic, antispasmodic, anti-periodic. Resembles very much in action hemlock, and somewhat digitalis, aconite, veratrum, antimony; heart action rendered slower and weaker, arterial tension lowered, motor cranial nerves paralyzed.

**USES.**—Rheumatic neuralgia, intermittent, typhoid, and yellow fevers, lung affections, dysmenorrhœa, delirium tremens, chorea, hysteria, epilepsy, sunstroke, tetanus, rhus-poisoning, coryza, opium-poisoning, odontalgia, cardiac palpitation, mania.

**Poisoning:** Have pain about the eyes, dim vision, sometimes double, dilated pupils, rapid and feeble pulse, dizziness, projected eyeballs, loss of sensation and motion, dropping of upper eyelid (ptosis) and lower jaw, inability to enunciate, cold moist skin, anxious face, pain in chest, slow, labored breathing, convulsions resemble those of strychnine-poisoning, feeling of suffocation, foaming at the mouth, respiration ceases, finally heart ceases to beat from asphyxiation, death; conscious until near the end. Give evacnants (stomach pump, mustard, zinc sulphate), or wash out stomach with tannic acid solution, follow with hypodermic of morphine, atropine, stimulants, ammonia, coffee, alcohol, digitalis, strychnine, external heat and friction.

**Incompatibles:** Cardiac and diffusible stimulants, caustic alkalies, tannin.

**Synergists:** Motor depressants.

## SPIGELIA. SPIGELIA.

**Spigelia**  
**marylandica, Linné.** } The dried rhizome and roots.

**Habitat.** United States, Maryland, southward, west to Texas, Wis.; in rich woods.

**Syn.** Pink Root, Maryland-, Carolina-, Indian-, or India-pink, Worm Grass or Weed, Star Bloom, American Worm Root, Loricera; Fr. Spigélie du Maryland; Ger. Spigelle, Marylandische Spigelle.

**Spi-ge'li-a.** L. *Spigélius*, after Adrian von der Spiegel (1558–1625), professor of anatomy and surgery at Padua, Flemish botanist, who first gave directions for preparing an herbarium.

**Ma-ry-lan'di-ca.** L. of, or belonging to Maryland—*i. e.*, its supposed habitat and one most northern.

**PLANT.**—Perennial herb; stems several, .3–.6 M. (1–2°) high, erect, round below, square above, purplish, smooth; leaves sessile, ovate-lanceolate, 5–7.5 Cm. (2–3') long, entire; flowers June–July, 4–12, large, sessile, on one side of stem above the leaves, spike; corolla funnel-shaped, 5 Cm. (2') long, scarlet-red outside, yellow inside; fruit compressed, 2-celled, yellow; seeds few, yellow. **RHIZOME**, of oblique and sharply flexuous growth, somewhat branched, 1.5–5 Cm. ( $\frac{3}{8}$ –2') long, 2–4 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ') thick, dark purplish-brown, blackish, upper surface knotty from approximate stem-bases bearing cup-shaped scars, lower surface with numerous long, coarse, finely branched roots, fracture short, wood yellowish, pith dark; odor somewhat aromatic; taste bitter, pungent. **Solvents:** diluted alcohol; boiling water. **Dose**, 3ss–2 (2–8 Gm.); children, gr. 10–20 (.6–1.3 Gm.).

**ADULTERATIONS.**—To a great extent—*Ruellia*, rhizome larger, lighter colored, fewer coarse roots, from which bark readily separates; *Phloxglaberrima*, rhizome and roots closely resemble spigelia, darker

and less ridged than ruellia; *Phlox carolina*, rhizome short, upright, roots brownish-yellow, coarse, straight, wood straw-colored, bark readily removable; earthy matter.

**Commercial.**—Pinkroot very seldom grows north of the Potomac River, and flourishes in rich soil near the borders of woods. The Creek and Cherokee Indians formerly collected much of it in Georgia, by pulling up entire plant and sending that into market in bales, 300–350 pounds (136–158 Kg.). Now only the official portion is collected, carefully dried, packed in casks or bales, and sent into commerce via St. Louis and New Orleans, coming mostly from S. W. States. That in casks is preferred, owing to its being less frequently damp and mouldy.

**CONSTITUENTS.**—Bitter principle, Spigeline, volatile oil, resins, tannin, wax, fat, gum.

**Bitter Principle.**—This is precipitated by tannin, but not by lead acetate, is soluble in water, alcohol, insoluble in ether.

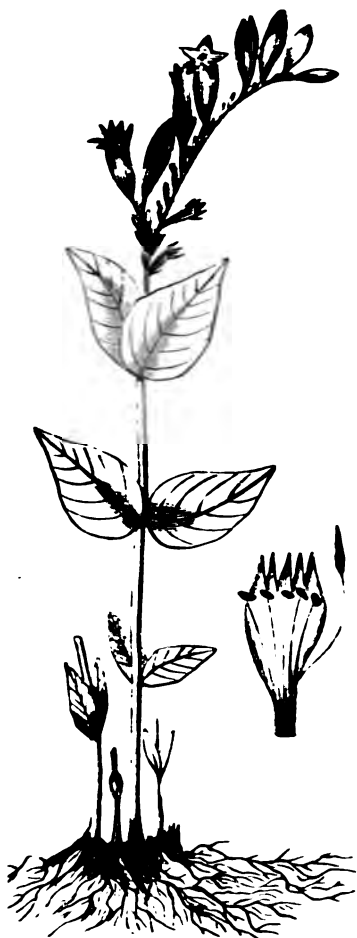
**Spigeline.**—Volatile alkaloid obtained by distilling with milk of lime over a paraffin-bath, collecting distillate in hydrochloric acid, evaporating to dryness, crystallizing from alcoholic solution. **Tests:** 1. With iodine get brownish-red precipitate. 2. With Mayer's test (potassio-mer-

curic iodide), white crystalline precipitate, soluble in alcohol, ether, acids, and its solubility in this latter distinguishes it from all other alkaloids. 3. Benzin removes from *Phlox carolina* a hydrocarbon (crystalline, white, tasteless), 1 p. c., fat, wax, red coloring matter, thus somewhat differing from spigelia when similarly treated.

**PREPARATIONS.**—1. *Fluidextractum Spigeliæ*. Fluidextract of Spigelia. (Syn., Extractum Spigeliæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Spigélie; Ger. Flüssiges Spigeliextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol

FIG. 309.

*Spigelia marylandica.*

**LOGANIACEÆ.**

q. s., evaporate to 100 Cc. Dose, ʒss–2 (2–8 Cc.); child 3 years old, ℥x–20 (.6–1.3 Cc.).

*Unoff. Prep.: Compound Infusion (Worm Tea)*, 15 Gm. + senna 10, fennel 10, manna 30, water q. s. 500 Cc., dose, ʒij–5 (60–150 Cc.).

**PROPERTIES.**—Anthelmintic, toxic, mydriatic. Large doses cause narcotic poisoning, vertigo, dim vision, mydriasis, spasms, convulsions; but if it should purge, as it often does, only a few of these symptoms occur—hence no danger when combined with a direct cathartic.

**USES.**—To destroy round worms (*Ascaris lumbricoides*); usually associated with a cathartic, as senna, calomel, etc., which hastens the removal of the benumbed worm from the system before it has time to recover from the effect of the spigelia.

*Poisoning:* Have dimness of vision, vertigo, dilated pupils, dry throat, convulsions, delirium. Give wine, ammonia, brandy, diffusible stimulants, amyl nitrite, atropine, digitalis.

*Allied Plants:*

1. *Spigelia anthel'mia*, *Demerara Pink Root*, *Worm Grass*—W. Indies. Used for a long time by the native Indians as a vermifuge and narcotic; fresh root has nauseous odor, is bitter, acrid, and kills cattle.

2. *Phlox' caroli'na*, *Carolina* or *Georgia Pink*.—This has a knotty and lighter colored rhizome with a central pith; it is also a good anthelmintic, as is likewise *P. glaber'rima*.

**NUX VOMICA. NUX VOMICA.**

**Strychnos** } The dried, ripe seed, containing 1.25 p. c. of strychnine.  
**Nux-vomica**, Linné. }

*Habitat.* India, Hindustan, E. India islands (Malabar, Ceylon, Java, N. Australia).

*Syn.* Dog, Quaker, or Bachelor's Buttons, Vomit or Poison Nut, Dog Poison, Ratsbane, False Angustura, Columbrina, Ordeal Root, Nux Metella, Semen Nucis Vomiceæ; Fr. Noix-vomique; Ger. Semen Strychni, Brechnuss, Krühenaugen.

**Strych'nos.** L. fr. Gr. στρούχνος, night shade, equivalent to *L. solanum*, used anciently for several poisonous plants, but not for the present one.

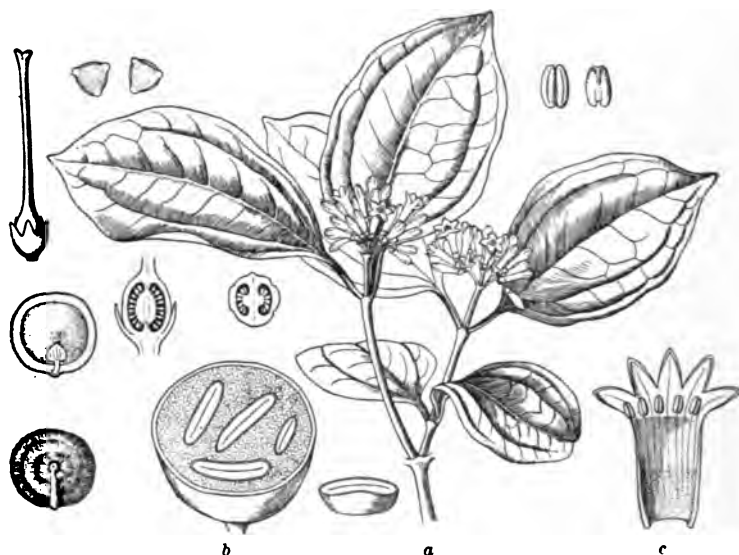
**Nux' Vom'i-ca.** L. *nux*, a nut, + *vomere*, to vomit—i. e., excessive doses may vomit, or require vomiting to save life, small doses may allay it.

**PLANT.**—Medium-sized tree, 6–12 M. (20–40°) high, trunk short, thick, crooked, resembling our dogwood, branches irregular, bark yellowish-gray, nearly smooth; leaves exstipulate, 5–10 Cm. (2–4') long, roundish, oval, 3–5-nerved, apex acute, entire, shining; flowers in winter, whitish, funnel-shaped, 8 Mm. (½') long, paniculate cymes; fruit small, shining, globular berry, resembling an orange, 4–5 Cm. (1½–2') thick, rind tough, thin, orange-yellow when ripe, filled with a harmless gelatinous pulp in which 1–5 seeds are irregularly immersed. **SEED**, orbicular, nearly flat, sometimes irregularly bent, 15–30 Mm. (¾–1½') broad, 3–5 Mm. (⅙–⅓') thick, grayish or greenish-gray, surface covered with short, closely appressed, satiny hairs, rounded or somewhat acute at the margin, with slight ridge from centre of one side to the edge, internally whitish-gray, horny, tough, endosperm in

two more or less regular concavo-convex halves, between which, at one end, lie the heart-shape, palmately nerved cotyledons; inodorous; taste intensely and persistently bitter; powder light gray, the epidermal cells modified to strongly lignified hairs, endosperm cells thick-walled, containing fixed oil, aleurone grains, giving a blue or violet with potassium dichromate and sulphuric acid; in the tissues of adhering fruit-pulp occur a few small, nearly spherical starch grains. *Solvents*: alcohol (75 p. c.); boiling water partially. Dose, gr.  $\frac{1}{2}$ –5 (.03–.3 Gm.).

*Commercial*.—The seeds are powdered best by breaking into small pieces, drying fragments for several days with hot air or carefully

FIG. 310.



*Strychnos Nux-vomica*: a, flowering branch ( $\frac{1}{4}$  natural size); b, cross-section of fruit; c, corolla; also anther, pollen, pistil, ovary, seed, enlarged.

applied direct heat; the best are recognized by their greater breadth, thinness of edge, lightness of color, excessive silkiness, prominent hilum. There are several varieties: 1. *Bombay*; 2. *Ceylon*; 3. *Cochin*; 4. *Madras*—named in order of value.

**CONSTITUENTS**.—Alkaloids 2.5–4–5.3 p. c.: Strychnine 0.25–2 p. c., Brucine 0.5–2 p. c., Igasurine (probably impure brucine), all combined with igasuric (strychnic, tannic, caffeo-tannic) acid; Loganin, fixed oil, proteids 11 p. c., yellow coloring matter, gum, sugar 6 p. c., ash 1–1.5 p. c. Dunstan and Short found total alkaloids to vary from 2.74 p. c. in small Madras to 3.9 p. c. in large, silky Bombay seeds, of which 30–50 p. c. was strychnine.

**Strychnina, Strychnine**,  $C_{21}H_{22}N_2O_2$ , *official*.—(Syn., Strychnia; Fr. Strychnine; Ger. Strychninum, Strychnin.) This alkaloid is found not only in *nux vomica*, but also in other loganiaceous plants; it was dis-

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covered by Pelletier, 1818, and may be obtained by boiling powdered seeds with acidulated ( $\text{HCl}$  or  $\text{H}_2\text{SO}_4$ ) water, thus liberating tannic (igasuric) acid, mucilage, coloring matter, etc., and forming chlorides or sulphates of the alkaloids; concentrate and add milk of lime to decompose alkaloidal salts (forming  $\text{CaCl}_2$  or  $\text{CaSO}_4$ ) and to precipitate strychnine and brucine; wash precipitate, treat it with diluted alcohol to dissolve brucine, or with alcohol or benzene to take out strychnine, thus leaving brucine in the mother-liquor. If diluted alcohol be used for brucine, then by boiling residue with alcohol strychnine is obtained; can purify with animal charcoal and reprecipitate with ammonia. It is in colorless, transparent, prismatic crystals, or white crystalline powder, odorless, intensely bitter (1 in 700,000), permanent, soluble in 6,400 parts water, 110 alcohol, 5,500 ether, 6 chloroform, 150 benzene, no residue; forms numerous salts (hydrochloride, nitrate, phosphate, sulphate, etc.). *Tests*: 1. Sulphuric acid produces no color (abs. of sugar, other readily carbonizable organic substances), until fragment of potassium dichromate added which gives deep blue, changing to deep violet, purplish-red, orange, yellow. 2. Dissolve 0.1 Gm. in nitric acid, evaporate, + ammonia water to yellow residue gives orange color, which with alcoholic potassium hydroxide T. S. turns reddish-purple and brown; when mixed with morphine can be dissolved out by chloroform. 3. Nitric acid should produce only faint pink color (lim. of brucine). Commercial strychnine contains some homo-strychnine,  $\text{C}_{22}\text{H}_{24}\text{N}_2\text{O}_2$ . Dose, gr.  $\frac{1}{80}$ – $\frac{1}{20}$  (.001–.003 Gm.).

**Strychninæ Nitræs, Strychnine Nitrate**,  $\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2 \cdot \text{HNO}_3$ , *official*.—(Syn., Fr. Azotate (Nitrate) de Strychnine; Ger. Strychninum nitricum, Strychninnitrat, Salpetersaures Strychnin.) Obtained by dissolving strychnine (1) in diluted nitric acid (1.886), when neutral evaporate, crystallize; it represents 84.13 p. c. of the alkaloid. It is in colorless, glistening needles, odorless, intensely bitter (1 in 700,000), permanent, soluble in 42 parts water, 120 alcohol, 156 chloroform, 60 glycerin, insoluble in ether. *Tests*: Similar to strychnine. Should be kept in well-stoppered vials. Dose, gr.  $\frac{1}{80}$ – $\frac{1}{20}$  (.001–.003 Gm.).

**Strychninæ Sulphas, Strychnine Sulphate**,  $(\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2)_2 \cdot \text{H}_2\text{SO}_4 + 5\text{H}_2\text{O}$ , *official*.—(Syn., Fr. Sulfate de Strychnine; Ger. Strychninum sulfuricum, Strychninsulfat, Schwefelsaures Strychnin.) Obtained by dissolving strychnine in hot diluted sulphuric acid in slight excess, evaporating filtrate, crystallizing; it represents 78.03 p. c. of the alkaloid. It is in colorless or white prismatic crystals, or white crystalline powder, odorless, intensely bitter (1 in 700,000), efflorescent, soluble in 31 parts water, 65 alcohol, 325 chloroform, insoluble in ether. *Tests*: Similar to strychnine. Should be kept in well-stoppered vials. Dose, gr.  $\frac{1}{80}$ – $\frac{1}{20}$  (.001–.003 Gm.).

**Brucine (Brucina)**,  $\text{C}_{23}\text{H}_{26}\text{N}_2\text{O}_4$ .—Named after James Bruce (1730–1794), a Scotch traveler, and obtained in extracting strychnine; occurs in rectangular, octahedral crystals, containing  $4\text{H}_2\text{O}$ , soluble in 850 parts water, readily in chloroform, alcohol, ammonia, creosote. Forms numerous salts, less bitter than strychnine, 12 times weaker, 3

times slower physiologically. By some considered to be strychnine + resin, as it has same action. *Test*: 1. With nitric acid get blood-red color, changing to orange-yellow; now add stannous chloride, sulphurous acid, or any deoxidizing agent, get a violet-red (this completely bleaches morphine-red). Dose, gr.  $\frac{1}{12}$ — $\frac{1}{2}$  (.005—.03 Gm.).

**Igasurine (Igasuria)**, fr. Malay, *igasura*, the nux vomica.—Obtained from mother-waters of strychnine and brucine after their precipitation with lime; occurs in white crystals; by some claimed to be a mixture of 9 alkaloids, mostly brucine; others doubt its existence.

FIG. 311.



Nux vomica: whole seed, cut longitudinally, and cut transversely.

**Igasuric Acid**.—Identical with tannic or caffen-tannic acid, amorphous, dark green with ferric salts, by hydrolysis yields glucose and caffeic acid.

**Loganin**,  $C_{22}H_{34}O_{14}$ .—Bitter glucoside, in white prisms, soluble in water, alcohol. With sulphuric acid get red, then purple, and splits into sugar and loganetin.

**Assay**: Exhaust nux vomica, fine powder, 20 Gm. with ether 137.5 Cc. + chloroform 44, + alcohol 13.5, + ammonia water 5, shake out 100 Cc. of tincture with normal sulphuric acid V. S. 15, 5, 3, transfer acid solutions to separator, render alkaline with ammonia water, shake out with chloroform 25, 15, 15, evaporate to dryness combined chloroformic solutions, dissolve residue in 3 p. c. sulphuric acid 15 Cc., + dilute nitric acid 3, shake, set aside, render resulting red liquid alkaline with 25 Cc. sodium hydroxide solution (1 in 10), shake out with chloroform 20, 10, 10, (5), evaporate chloroformic solutions to dryness, dissolve alkaloidal residue in 6 Cc.  $\frac{N}{10}$  sulphuric acid V. S., ether 20, distilled water 80, titrate excess of acid with  $\frac{N}{50}$  potassium hydroxide V. S., using iodeosin T. S. indicator. Divide number Cc. of  $\frac{N}{50}$  V. S. used by 5, subtract this from 6, multiply remainder by 0.0332, and this product by 10 = p. c. of strychnine present.

**PREPARATIONS**.—1. *Extractum Nucis Vomice*. Extract of Nux Vomica. (Syn., Fr. Extrait de Noix-vomique; Ger. Extractum Strychni (Spirituosum), Brechnussextrakt, (Weingeistiges) Krähenaugenextrakt.)

**Manufacture**: Contains 5 p. c. strychnine. Macerate, percolate 100 Gm. with water 130 Cc. + acetic acid 50 Cc., finishing with water alone, reserve first 75 Cc., heat remainder, filter, evaporate to soft extract, dissolve in reserved portion, add water q. s. 90 Cc., add

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alcohol 300 Cc., after 24 hours evaporate filtrate to dryness; determine by assay amount of strychnine present, add to remaining extract sugar of milk sufficient to make quantity of strychnine 5 p. c. of total weight. *Assay*: Dissolve 2 Gm. in 25 Cc. of mixture—ether 16, chloroform 5, ammonia water 4, shake, draw off aqueous layer, which shake out with chloroform 15, 10, and add same to ether-solution, shake out this with sulphuric acid (3 p. c.), 15, 10, 10, and proceed approximately as in assay of nux vomica, dividing by 5, subtracting from 10, multiplying by 0.0332, and this product by 50. Should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.).

Prep.: 1. *Tinctura Nucis Vomice*. Tincture of Nux Vomica. (Syn., Fr. Teinture de Noix-vomique; Ger. Tinctura Strychni, Brechnusstinktur, Krähenaugentinktur.)

*Manufacture*: Extract of nux vomica 2 Gm., dissolved in alcohol 75 p. c., q. s. 100 Cc.; when assayed each 100 Cc. should contain 0.1 Gm. of strychnine. *Assay*: Evaporate 100 Cc. to dryness, and proceed approximately as in assay of the extract, except omitting the multiplication by 50. Dose, Mv–20 (.3–1.3 Gm.).

2. *Fluidextractum Nucis Vomice*. Fluidextract of Nux Vomica. (Syn., Extractum Nucis Vomice Fluidum, U. S. P. 1890; Fr. Extrait liquide de Noix-vomique; Ger. Flüssiges Krähenaugen (Strychnossamen)-extrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c. 100 Cc. + acetic acid 5 Cc., finishing with alcohol 75 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 1 Gm. of strychnine. *Assay*: Evaporate to dryness 10 Cc., dissolve residue in mixture—ether 16, chloroform 5, ammonia water 4, and proceed approximately as in extract of nux vomica, multiplying final product by 10 instead of 50. Dose, Mj–5 (.06–.3 Cc.).

*Unoff. Preps.*: *Strychnine Hydrochloridum* (Br.). *Liquor Strychnine Hydrochloridi* (Br.), 1 p. c., dose, Mij–8 (.13–.5 Cc.). *Abstract*, dose, gr.  $\frac{1}{4}$ –2 (.016–.13 Gm.). *Decoction* of leaves used externally in rheumatism.

**PROPERTIES.**—Motor excitant, spinant, tonic, stomachic, respiratory, cardiac, muscular, and nervous stimulant, antiseptic, poisonous. Strychnine and nux vomica are identical, increasing the vascularity of gastric mucous membrane, secretion of gastric juice, and peristalsis by stimulating the intestinal muscular coat (purgative), stimulates direct the cardiac muscles or the motor ganglia and nerves of special sense; strychnine, full dose, gr.  $\frac{1}{16}$  (.006 Gm.), gives dilated pupils, jerky limbs, spasmodic respirations, stiff lower jaw, cerebral tension, shuddering, depression, facial smile or grin. Thebaine (opium) acts similarly. The spasms of tetanus are constant, of strychnine intermittent, with meaningless smile; the modified lockjaw, absence of wound, and rapidly developed symptoms differentiate the two. Strychnine is absorbed rapidly, but slowly eliminated by urinary, salivary, and cutaneous channels.



**USES.**—Strychnine was used first in paralysis, and now in atonic dyspepsia, gastric catarrh, bowel atony, pregnancy and phthisis vomiting, nervous cough, bronchitis, anæmia, paralytic condition, lead palsy, inebriate and diphtherial paralysis, amaurosis from lead, tobacco, alcohol, paralysis of bladder, incontinence of urine, sexual impotence, tetanus, chorea, epilepsy, delirium tremens, spermatorrhœa, neuralgia, dysmenorrhœa, diarrhœa, dysentery, cholera, antidote to hydrated chloral, morphine, physostigmine. A tolerance for it is soon established, but gr.  $\frac{1}{12}$  (.005 Gm.) has killed, while gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.) is, as a rule, considered fatal; extract, gr. 3 (.2 Gm.) also have killed.

**Poisoning:** Strychnine, gr.  $\frac{1}{2}$  (.03 Gm.) or more, produces within half an hour difficult breathing, sense of suffocation and impending death, muscular rigidity, stiffness of neck, tonic or persistent convulsions of all extensor muscles, coming on at intervals 3–30 minutes, lasting 1–5 minutes, these quickly recurring at every noise or irritation, between convulsions complete relaxation, face dusky and with ghastly grin, angles of mouth drawn back and upward, body curved so as to rest on head and heels, eyeballs prominent, pupils dilated during paroxysm, eyes fixed and open, lips livid, great thirst but unable to drink owing to spasms of jaws, respiration suspended during convulsions, pulse feeble and rapid, involuntary defecation and urination, lockjaw, death in 2–3 hours from asphyxia; mind clear until near the end, when carbon dioxide narcosis may set in. Place in horizontal position, in dark room remote from all noise, use evacuants (stomach-pump, emetics, purgatives), follow with antidotes; tannin dissolved in water, charcoal, potassium permanganate, hydrated chloral, and potassium bromide, by mouth or rectum, chloroform, ether, amyl nitrite, (soluble iodides, tobacco, opium, physostigmine, atropine, conium, indian hemp). Empty bladder often (catheter), practise artificial respiration.

**Incompatibles:** Hydrated chloral, potassium bromide, tobacco, chloroform, ether, tannin, bromides, iodides, chlorides.

**Synergists:** Motor excitants, ergot, ustilago, electricity, cold.

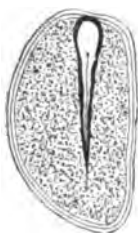
#### *Allied Product:*

1. The bark was once (1806–1837) upon the market in England and Holland, being usually mixed with *Angustura*, and since then has been known as *False Angustura Bark*; it is poisonous, gray, cork patches rust-color, warty, inside brown, fracture smooth, no white striæ (calcium oxalate); contains strychnine, brucine, etc. The wood is used in domestic medicine; all portions are medicinal.

#### *Allied Plants:*

1. *Strychnos Ignatia*, *Bean of St. Ignatius*.—The seed, official 1860–1890; Philippine Islands. Large climbing shrub, leaves ovate, acute at apex, smooth, flowers white, tubular, racemes; fruit resembles a pear, pericarp brittle; seeds 24, imbedded in bitter pulp, 25 Mm. (1') long, 18 Mm. ( $\frac{3}{4}$ ') broad, ovate, triangular, brownish, covered with

FIG. 312.



*Ignatia*: vertical section.

## GENTIANACEÆ.

brown silky hairs, horny, very bitter; contains more strychnine, but less total alkaloids than nux vomica—strychnine 0.5–1.5 p. c., brucine 0.5–1.4 p. c., proteids 10 p. c.; used like nux vomica; in tincture. Dose, gr.  $\frac{1}{2}$ –3 (.03–.2 Gm.).

2. *S. Tieu'te*.—Java; seeds resemble nux vomica but smaller, whiter; contain strychnine, brucine; extract used natively for arrow poison. *S. potato'rum*, India; seeds subglobular, 12 Mm. ( $\frac{1}{2}$ ') wide, brownish-gray, not bitter, no strychnine; used natively for clearing muddy water. *S. Colubri'na*, India; yields true *Lignum Colubrinum*, for which nux vomica branches often are substituted. All parts bitter and contain strychnine and brucine; once used as antidote to snake-bites, hence the name.

3. *S. toxic'era* (*Castelneæ'na*), *Curara*, *Curare*, *Woorara*, *Urari*.—Brazil, Guiana. Extract of bark (South American arrow poison), blackish, hygroscopic, bitter, friable, 75 p. c. soluble in water; contains curarine,  $C_{18}H_{35}N$  (yellowish-brown, bitter alkaloid), resin, fat. Diaphoretic, sedative, irritant; best drug in tetanus. Dose, gr.  $\frac{1}{10}$ – $\frac{1}{2}$  (.006–.02 Gm.); curarine gr.  $\frac{1}{100}$  (.0006 Gm.)—resembles digitalis in action.

## 67. GENTIANACEÆ. Gentian Family.

Jen-shia-na'se-e. L. *Gentian-a* + aceæ, fr. Gr. γέντιανή—i. e., after Gentius, King of Illyria, who first discovered and experienced its virtues. Herbs or shrubs. Distinguished by being smooth, with bitter principles; leaves exstipulate, entire, glabrous, sessile; flowers regular, 5's, sometimes 4, 6, 8, 10; ovary 1-celled; fruit capsule, 1–2-celled, 2-valved; seeds many; universal; tonic, febrifuge, stomachic.

Genera: 1. *Gentiana*. 2. *Swertia*.

## GENTIANA. GENTIAN.

*Gentiana* }  
*lutea*, Linné. } The dried rhizome and roots.

*Habitat.* C. and S. Europe; mountains.

*Syn.* Yellow or Pale Gentian, Bitter Root or Wort, Felwort, Radix Gentianæ Rubræ, Luteæ or Majoris; Br. Gentianæ Radix; Fr. Racine de Gentiane (de Gentiane jaune); Ger. Radix Gentianæ, Enzianwurzel, Bitterwurzel, Rother (Gelber) Enzian.

*Gen-ti-a'na.* L. see etymology, above, of Gentianaceæ.

*Lu'te-a.* L. *luteus*, golden-yellow—i. e., the flowers.

**PLANT.**—Large perennial herb, remarkable for beauty and size; stem thick, hollow above, .6–1.3 M. (2–4°) high, yellowish-green; leaves entire, 5–7-nerved, 15–30 Cm. (6–12') long, ovate, glabrous, yellowish-green; flowers June–Aug., numerous, in cymes of 20 or more; corolla 5 Cm. (2') long, orange-yellow, 6 segments; fruit 1-celled, ovate capsule, 3 Cm. (1 $\frac{1}{2}$ ') long, with many winged-seeds. **ROOT**, in nearly cylindrical pieces or longitudinal slices, .3–.6 M. (1–2°) long, or shorter, 5–35 Mm. ( $\frac{1}{5}$ –1 $\frac{2}{5}$ ') thick, yellowish-brown, rhizome annulate, roots longitudinally wrinkled, fracture short, uneven,

bark rather thick, separated from the somewhat spongy, reddish-yellow or brownish inner portion by a dark brown cambium zone; flexible and tough when damp; odor strong, characteristic; taste slightly sweetish, strongly, persistently bitter; powder free from starch grains, tannin, calcium oxalate, and sclerenchymatic tissues. *Solvents*: water; diluted alcohol. Dose, gr. 5–30 (.3–2 Gm.).

**ADULTERATIONS.**—Through carelessness—roots of allied species, aconite, belladonna, white hellebore, orris, etc., none being yellow internally.

**Commercial.**—Gentian was used by the Greeks and Arabians; it grows in the Alps, Apennines, Pyrenees, 900–1,200 M. (3,000–4,000°) elevation, along with veratrum, the leaves of both closely resembling. Flourishes best in France, Switzerland, Portugal, Germany, England. Roots are dug, washed, dried in mountainous districts, and exported from Germany, also Marseilles (France)—our chief source.

**CONSTITUENTS.**—Gentiopicroin 0.1 p. c., Gentisin, gentianose,  $C_{16}H_{26}O_{31}$  (uncrystallizable sugar), 14 p. c., resin, gum, pectin, fixed oil 6 p. c., yellow coloring matter, identical with quercitrin, ash 8 p. c.

**Gentiopicroin**,  $C_{20}H_{30}O_{12}$ .—Bitter glucoside obtained by making aqueous solution

of alcoholic extract, from which it is absorbed by charcoal; now boil with alcohol, concentrate, treat with lead oxide to remove color, precipitate lead by hydrogen sulphide, agitate with ether, crystallize. It is colorless or in yellowish needles, soluble in water, diluted



*Gentiana lutea.*

FIG. 314.



Gentian root, longitudinally sliced, about one-half natural size.

alcohol, with diluted acid splits into glucose and gentiogenin,  $C_{14}H_{16}O_5$  (yellowish-brown).

**Gentisin, Gentianin** (*Gentisic* (*Gentianic*) *Acid*),  $C_{14}H_{10}O_5$ .—Glucoside obtained by washing the alcoholic extract with cold water to remove bitter principle, afterward with ether to remove fat, and finally crystallizing from alcohol; it is in yellow, tasteless crystals, partially soluble in alcohol, ether; colors ferric salts dark brown; by some considered gentiotannic acid. The pectin compound is precipitated by lead acetate.

## GENTIANACEÆ.

PREPARATIONS.—1. *Extractum Gentianæ*. Extract of Gentian. (Syn., Fr. Extrait de Gentiane; Ger. Enzianextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with water q. s., evaporate; yield 30 p. c. Dose, gr. 2–10 (.13–.6 Gm.).

2. *Fluidextractum Gentianæ*. Fluidextract of Gentian. (Syn., *Extractum Gentianæ Fluidum*, U. S. P. 1890; Fr. Extrait liquide de Gentiane; Ger. Flüssiges Enzianextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, ℥v–30 (.3–2 Cc.).

3. *Tinctura Gentianæ Composita*. Compound Tincture of Gentian. (Syn., Fr. Teinture de Gentiane composée; Ger. Zusammengesetzte Enziantinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. + bitter orange-peel 4, cardamom 1, with alcohol 60 p. c., q. s. 100 Cc. Dose, ʒj–2 (4–8 Cc.).

*Unoff. Preps.*: *Infusum Gentianæ Compositum* (Br.), 1.25 p. c., + bitter orange-peel 1.25, lemon-peel 2.5, dose, ʒss–2 (15–60 Cc.). *Tincture*, 20 p. c.

PROPERTIES.—Tonic, bitter, increases appetite, digestion (action local). Large doses oppress stomach, irritate bowels, nauseate, and cause vomiting.

USES.—Dyspepsia, atonic gout, amenorrhœa, hysteria, scrofula, intermittents.

*Allied Plants*:

1. *Gentiana Elliot'tii* (*Catesba'i*), *Elliott's Gentian*.—The root, official 1820–1880. United States, grassy swamps. Perennial herb (20–60 Cm. (8–24') high, rough; leaves 2.5–5 Cm. (1–2') long, lanceolate, serrate; flowers Oct., blue, 4 Cm. (1½') long; corolla 10 segments, 5 inner fringed; root resembles the official; constituents and uses similar; in infusion, wine, tincture. *G. purpurea* (purplish flowers), *G. pannonica* (dark purple flowers), and *G. punctata* (yellow, purple-dotted flowers); all grow along with official, and collected for it.

2. *Sabba'tia angulata*, *American Centaury*.—The herb, official 1820–1880. United States. Plant .3–.6 M. (1–2°) high, stem branched above, square, smooth; leaves ovate, 2.5 Cm. (1') long, heart-shaped; flowers deep rose, central star greenish, wheel-shaped, 5-parted, bitter; contains bitter principle, fat, erythrocentaurin. Used as tonic, febrifuge, diaphoretic, rheumatism, sore throat, fevers. Dose, gr. 15–60 (1–4 Gm.). *S. Elliot'tii*, *Quinine Flower*; *S. campestris*, and *Erythræa Centaurium*, *European Centaury*; all these may be used similarly.

## CHIRATA. CHIRATA.

**Swertia**

**Chirayita** (*Chirata*), (*Rozburg*) *Hamilton*. } The dried plant.

*Habitat*. N. India, mountains, 1,500–2,700 M. (5,000–9,000°) elevation.

*Syn.* Bitter (stem) Stick, East India Balmony, Chiretta, Chirayta; Fr. Chirette; Ger. Chiretta, Ostindischer Enzian.

*Swert'i-a*. L. in honor of Emanuel Swert, Holland florist, who published *Florilegium*, in 1612.

*Chi-ray'i-ta*, *Chi-ra'ta*. L. for E. Indian *kirdas*, a race of mountaineers, among whom this plant grows, and by them extensively used.

**PLANT.**—Smooth annual, stem about 1 M. ( $3^{\circ}$ ) high, yellowish or purplish-brown, cylindrical near base, quadrangular and lightly-winged above, with numerous opposite, ascending branches; wood yellowish, thin, enclosing usually large yellowish separable pith; root simple, about 7 Mm. ( $\frac{1}{4}$ ') thick near the crown; leaves opposite, sessile, ovate-lanceolate, entire, 5-nerved, 6 Cm. (2.5') long; flowers small, paniced, calyx and corolla 4-lobed, capsule ovoid, acute, 1-celled, many-seeded; odor slight; taste intensely bitter. Should be collected when flowers begin decaying, dried and tied into bundles with bamboo, 1 M. ( $3^{\circ}$ ) long, weighing 1-2 pounds (.5-1 Kg.); enters market via Bombay, where it is garbled. *Solvents*: water; alcohol; diluted alcohol. Dose, gr. 15-30 (1-2 Gm.).

**CONSTITUENTS.**—Ophelic acid, Chiratin, ash 4-8 p. c. (K, Ca, Mg, carbonates and phosphates).

**Ophelic Acid**,  $C_{13}H_{20}O_{10}$ .—Bitter, syrupy liquid, soluble in water, alcohol, not precipitated by tannin.

**Chiratin, Chirettin**,  $C_{26}H_{48}O_{15}$ .—Bitter glucoside, crystalline, yellow, hygroscopic, soluble in ether, alcohol, warm water, precipitated by tannin, with dilute acids splits into ophelic acid and chiratogenin.

**PREPARATIONS.**—1. *Fluidextractum Chiratae*. Fluidextract of Chirata. (Syn., Extractum Chiratae Fluidum, U. S. P. 1890; Fr. Extrait liquide de Chirette; Ger. Flüssiges Chirettaextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, ℥xv-30 (1-2 Cc.).

2. *Tinctura Chiratae*. Tincture of Chirata. (Syn., Fr. Teinture de Chirette; Ger. Chirettatinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with alcohol 65 p. c., q. s. 100 Cc. Dose, ʒss-1 (2-4 Cc.).

*Unoff. Preps.*: *Infusum Chiratae* (Br.), 5 p. c., dose, ʒss-2 (15-60 Cc.). *Liquor Chiratae Concentratus* (Br.), 50 p. c., dose, ʒss-1 (2-4 Cc.).

**PROPERTIES.**—Tonic, febrifuge, stomachic, laxative; large doses nauseate. Good substitute for gentian, calumba, and other bitters.

**USES.**—Liver affections, costiveness, dyspepsia, debility, intermittents, bronchitis.

*Allied Plants*:

1. *Swertia angustifolia*, and *S. pulchella*.—Both have entire stems square, pith thin or wanting; less bitter than, and used to adulterate the official.

2. *Fra'sera carolinensis* (*Walteri*), *American Colombo*.—The root, official 1820-1880. United States. Perennial herb, 1-2.5 M. ( $3-8^{\circ}$ ) high, dark purple stem 2.5-5 Cm. (1-2') thick; leaves in whorls 4-6, entire, spatulate; flowers July, yellow, purple-dotted, large; root fusiform, fleshy, yellow. Usually in segments 2.5 Cm. (1') thick, annulate, orange-brown; odor gentian-like; taste sweet, bitter; constituents and uses like gentian. Dose, gr. 15-30 (1-2 Gm.).

3. *Menyanthes trifoliata*, *Water Shamrock*, *Buck* or *Bog-bean*.—The root (rhizome), official 1820-1840. Dried leaves; United States.

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Perennial herb, 2.5–3.7 M. (8–12°) high; root 12 Mm. ( $\frac{1}{2}$ ') thick, long, jointed, branching, black; leaves on petioles, 10–15 Cm. (4–6') long, ternate, leaflets sessile, 5–8 Cm. (2–3') long, obtuse, obovate, entire or crenate, smooth, pale green, inodorous, bitter; contains

FIG. 315.

*Menyanthes trifoliata.*

menyanthin (glucoside, yields menyanthol), mucilage, albumin, saccharose, fat. Used as tonic, febrifuge, emmenagogue, antiscorbutic, vermifuge; large doses emetic, purgative; rheumatism, scrofula, scurvy, dropsy, intermittents, jaundice, dyspepsia, worms. Dose, gr. 15–30 (1–2 Gm.).

**68. APOCYNACEÆ. Dogbane Family.**

**A-pos-i-na'se-e.** L. *Apocyn-um* + aceæ, fr. Gr. ἀπό, from, away, + κύων, a dog—*i. e.*, drives away or kills dogs, hence dogbane. Trees or shrubs. Distinguished by being milky, acrid, poisonous; leaves exstipulate, entire; calyx and corolla 5-lobed; from Asclepiadaceæ by stamens being free from style and stigma (insertion on the corolla), and granular pollen, filaments distinct; ovary 2, usually separate; fruit 2 follicles or drupes; tropics; purgative, tonic, febrifuge, poisonous.

Genera: 1. **Apocynum.** 2. **Strophanthus.**

**APOCYNUM. APOCYNUM.**

**Apocynum cannabinum, Linné,** } The dried rhizome.  
or closely allied species.

**Habitat.** United States, Canada to Florida; grassy places, fields, borders of woods.

**Syn.** Canadian Hemp, American (Black Indian) Hemp, Bowman's Root, Amy-root, Milk-weed, Rheumatism-weed, Wild Cotton, Indian Physic; Fr. Chanvre du Canada; Ger. Canadische Hanfwurzel.

**A-poc'y-num.** L. see etymology, above, of Apocynaceæ.

**Can-nab'i-num.** L. adj. form of *cannabis*, Gr. κάνναβις, hemp, so called fr. Ar. name *ganah*, Celtic *can*, reed + *ab*, small—*i. e.*, from strong fibres of stem-bark, resembling the bast fibres of hemp.

PLANT.—Perennial, abounding in adhesive milky juice ; stem purplish, 1–2 M. ( $3-6^{\circ}$ ) high, bark tough, fibrous ; leaves mucronate ; flowers July–Aug., numerous, greenish-white or reddish ; fruit follicle 15–20 Cm. (6–8') long, 3–4 Mm. ( $\frac{1}{8}-\frac{1}{4}$ ') thick. RHIZOME, varying length, 3–8 Mm. ( $\frac{1}{8}-\frac{1}{3}$ ') thick, cylindrical, longitudinally wrinkled, transversely fissured, orange-brown, but gray-brown on keeping, brittle,

FIG. 316.

*Apocynum cannabinum.*

fracture exhibiting a thin brown layer of cork, the remainder of bark as thick as the wood, white or pinkish, starchy, containing laticiferous ducts ; wood yellowish, of several rings, finely radiate, coarsely porous ; almost inodorous ; taste starchy, bitter, acrid. The bitterness is in the bark, which constitutes 65 p. c. of the root. *Solvents*: boiling water ; alcohol 65 p. c. Dose, diuretic, antiperiodic, gr. 2–5 (.13–.3 Gm.) ; emetic, gr. 15–30 (1–2 Gm.).

*Commercial*.—The root on the market is that collected from three or four good species, all having similar properties.

CONSTITUENTS.—Apocynin, Apocynein, tannin, resin, bitter extractive, starch, ash 11 p. c.

**APOCYNACEÆ.**

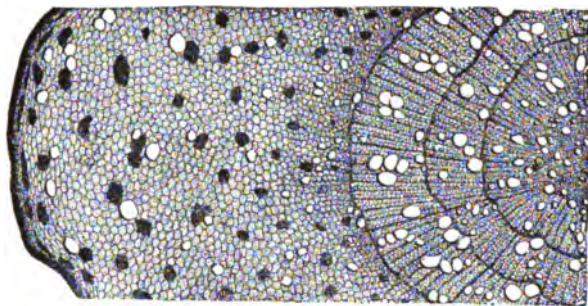
**Apocynin.**—This is resin-like, amorphous, yellowish-white, not a glucoside, soluble in alcohol, ether, insoluble in water. Dose, expectorant, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.016–.03 Gm.).

**Apocyneïn.**—A yellowish glucoside, acts like digitalin, soluble only in alcohol or water.

**PREPARATIONS.**—1. *Fluidextractum Apocyni.* Fluidextract of Apocynum. (Syn., Extractum Apocyni Fluidum, U. S. P. 1890, Fluidextract of Canadian Hemp; Fr. Extrait liquide de Chanvre du Canada; Ger. Flüssiges Canadische-Hanfwurzelextrakt.)

*Manufacture:* Macerate, percolate 100 Gm. with glycerin 10 Cc.,

FIG. 317.



*Apocynum cannabinum*: root, transverse section, magnified 25 diam.

alcohol 60, water 30, finishing with alcohol 60 p. c., q. s., evaporate to 100 Cc. Dose,  $\mathfrak{Mij}$ –5–30 (.13–.3–2 Cc.).

*Unoff. Preps.:* *Decoction*, 5 p. c. (boiled to two-thirds), dose,  $\mathfrak{Zss}$ –1 (15–30 Cc.). *Aqueous Extract*, dose, gr. 1–4 (.06–.26 Gm.). *Tincture*.

**PROPERTIES.**—Diuretic, diaphoretic, expectorant, tonic, antiperiodic, cardiac stimulant, alterative, antisyphilitic, emetic, cathartic.

**USES.**—Dropsy, dyspepsia, intermittents.

*Allied Plant:*

1. *Apocynum androsaemifolium*, *Spreading Dogbane*.—The rhizome (root), official 1820–1880; N. America. Grows with official plant, but has stem more spreading, leaves broader, rhizome thinner, tougher, with central pith, bark much thinner, containing a layer of stone-cells, wood porous, flowers pink; constituents and uses same as official.

**STROPHANTHUS. STROPHANTHUS.**

**Strophanthus** } The ripe seed, deprived of its long awn.  
**Kombé, Oliver.** }

*Habitat.* Tropical Africa (Kombé, Guinea, Senegambia), Asia, Philippines.

*Syn.* Br. *Strophanthi Semina*; Fr. *Semence de Strophanthe*; Ger. *Semen Strophanthi*, *Strophanthussamen*.

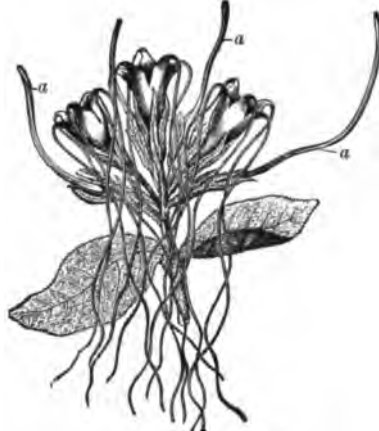
**Stro-phan'thus.** L. fr. Gr. *στροφή*, turning, to turn, twist, + *άνθος*, a flower—i. e., from the twisted and tailed lobes of the corolla.

**Kom-be'.** Native place of plant, in Gaboon district, Africa.



**PLANT.**—Woody climber of forests, between the coasts and centre of the continent, reaches highest trees, hanging in festoons, and in coils upon the ground; stem emits milky juice and is several inches thick; flowers Oct.—Nov., cream-colored, yellow at base, purple-spotted above, cymes; corolla gamopetalous, lobes extended in narrow, tail-like ends,

FIG. 318.



*Strophanthus Kombé*: flowering branch; a, a, a, budding branches.

22.5–30 Cm. (9–12') long; fruit June, pair of follicles, 20–37.5 Cm. (8–15') long, each containing about 200 long-awned seeds; collected by natives, who peel off husks (epicarp and mesocarp), preserving and drying the more leathery inner covering (endocarp), which encloses the seed, as such being smooth, yellowish-brown. **SEEDS**, 15 Mm. ( $\frac{3}{8}$ ') long, 4–5 Mm. ( $\frac{1}{8}$ – $\frac{1}{5}$ ') wide, 2–2.5 Mm. ( $\frac{1}{12}$ – $\frac{1}{10}$ ') thick, light fawn-brown, with greenish tinge, lance-ovoid, obtuse at base, gradually acuminate, somewhat acute at summit, usually twisted, on one side ridge from centre to apex, silky-lustrous from dense coating of closely appressed hairs in grooves, fracture short, soft, surface whitish, oily, kernel consisting of thin endosperm enclosing straight cotyledons; odor slight, heavy when crushed and moistened; taste very bitter. Occurs in market in pods or clean seeds; of the fruit, seeds = 37 p. c., endocarp (pod) 37 p. c., hairs 25 p. c.; the lighter in color the pappus the higher in grade the contained seeds. **Tests**: 1. Crushed or cut endosperm or cotyledons give green color with sulphuric acid. 2. Under microscope hairs are light greenish-brown, 1 Mm. ( $\frac{1}{25}$ ') long, consisting of one thin-walled cell. 3. Decoction (10 p. c.) is brownish, not changed by iodine T. S., ferric chloride T. S., or mercuric potassium iodide T. S. **Solvents**: alcohol (65 p. c.); boiling water partially. **Dose**, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.).

**ADULTERATIONS.**—Brown strophanthus seeds, *S. hispidus*, (W. Africa), dark brown, stouter, shorter, more abruptly contracted point, hairs fewer, shorter and stouter than official, giving red color with sul-

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phuric acid; White woolly strophanthus, *S. Nicholson'ii* (*as'per*), hairs white, long, producing shaggy stout appearance; *S. gra'tus*, seeds brown, without hairs; *S. Courmon'tii*, seeds small, brownish, ventral ridge obscure, with calcium oxalate crystals; *Kickx'ia africa'na*, seeds with both ends acuminate, terete, hairless.

CONSTITUENTS.—Strophanthin 1–3 p. c., choline, trigonelline, fixed oil 25–30 p. c., starch, proteids, etc.

**Strophanthinum, Strophanthin**,  $C_{40}H_{66}O_{19}$ , *official.* — (Syn., Fr. Strophantine; Ger. Strophanthin.) This glucoside or mixture of glucosides is obtained by exhausting seeds with ether or petroleum benzin (removing fat), then extracting with 70 p. c. alcohol, reclaiming latter,

FIG. 319.



*Strophanthus Kombe*: capsule, one-half natural size.

dissolving residue in water, filtering; add tannin, wash precipitate, mix with litharge, dry, exhaust with alcohol, precipitate with ether; heated with diluted hydrochloric acid becomes hydrolyzed, yielding strophanthidin,  $C_{27}H_{38}O_7 + 2H_2O$ , which precipitates, and strophanthobiose-methyl-ether,  $C_{12}H_{21}O_{10}CH_3$ , remaining in solution. It is a white or yellowish crystalline powder, intensely bitter, permanent, soluble in water, diluted alcohol, nearly insoluble in ether, chloroform, benzene. *Tests*: 1. With sulphuric acid gives emerald-green, changing to brown. 2. Aqueous solution + trace ferric chloride T. S. + few Cc. sulphuric acid, get red-brown precipitate, turning dark green. Seeds contain most, follicles and hairs some. Should be kept in well-stoppered, amber-colored vials. Dose, gr.  $\frac{1}{300}$ – $\frac{1}{120}$  (.0002–.0005 Gm.).

**Fixed Oil.**—Brownish-green, non-drying, heavy odor, sp. gr. 0.925, contains volatile oil, phytosterin, formic acid, oleates, stearates, arachinates; may be the irritating ingredient.

**PREPARATIONS.**—1. *Tinctura Strophanthi*. Tincture of Strophanthus. (Syn., Fr. Teinture de Semences de Strophanthe; Ger. Strophanthus(samen)tinktur.)

**Manufacture:** 10 p. c. Macerate, percolate 10 Gm. with alcohol 65 p. c., q. s. 100 Cc. Dose,  $\text{m}\text{j}$ –10 (.06–.6 Cc.).

**Unoff. Preps.:** *Extractum Strophanthi* (Br.), 50 p. c., dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.). *Decoction*, 1 p. c., dose,  $\text{m}\text{x}$ –60 (.6–4 Cc.). **Test:** 1. The tincture or extract + ferric chloride T. S. + sulphuric acid, gives brown precipitate changing to green after 1 hour, and so remains 3–4 hours.

**PROPERTIES.**—Similar to digitalis; heart stimulant, diuretic. Acts directly on muscular tissue of the heart, increasing the contractile power. Small doses stimulate contractions, strengthen the force and lower the rate of heart-beats, thus prolonging diastole without altering the duration of the systole, making regular an irregular heart; large doses paralyze the heart, leaving cardiac muscle rigid. It is a better diuretic and a more powerful cardiac stimulant than digitalis, the effect coming on much more quickly, yet being less permanent; reduces pulse and temperature, but is not cumulative, nor does it occasion gastro-intestinal derangement; the increased cardiac action stimulates renal circulation, thereby causing the diuretic action.

**USES.**—Cardiac dyspnoea, chronic Bright's, valvular heart lesions, palpitation, weak heart, pulmonary oedema from pneumonia, cardiac dropsy, endocarditis, hysteria, chlorosis, renal calculi, asthma, exophthalmic goitre. The effect is felt within half an hour, lasting 4–8 hours, reducing pulse 10–30 beats, at the same time increasing force and volume. The natives make of it an arrow poison (*kombé*), which is an extract, to be applied as a coating over several inches of the pointed end. Game, when wounded, soon becomes exhausted, but flesh is not injured by the poison.

**Poisoning, Incompatibles, Synergists:** Same as for digitalis.

**Allied Plants:**

1. *Strophanthus diehot'onus*, *False Strophanthus Seeds*.—These are chestnut-brown and less densely covered with hairs, otherwise resemble the official.

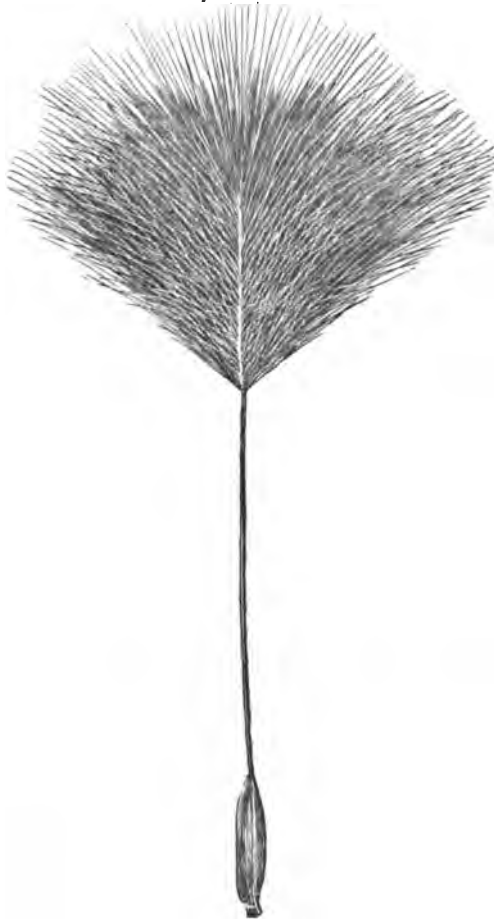
2. *S. his'pidus*.—This synonym was given the official plant, when both were considered identical, their then considered slight differences being attributed to simply soil, climate, etc; they are recognized now as distinct, possessing certain individual characteristics in plant as well as seeds.

3. *Aspidosper'ma Quebra'cho-blan'co*, *Aspidosperma*, *Quebracho*.—The bark, taken from old trees having thick corky layer, official 1890–1900; S. America (Argentine Republic, Chile). Evergreen tree, 24–30 M. (80–100°) high, resembling the weeping willow; wood yellowish to chocolate-brown; leaves small, entire; flowers small,

**APOCYNACEÆ.**

yellow. Bark, in pieces of irregular length, 12–30 Mm. ( $\frac{1}{2}$ – $1\frac{1}{5}$ ') thick, outside yellowish-gray, deeply fissured, inner surface reddish-yellow, striate; fracture shows 2 strata of equal thickness—cork and bast layers; the former orange-brown, granular, the latter brownish, short-splintery; inodorous; bitter, aromatic; contains aspidospermine, aspidospermatine, aspidosamine, quebrachine, quebrachamine, hydroquebrachine, quebrachite (sugar), tannin 3–4 p. c.

FIG. 320.



Strophanthus seed with comose awn.

Tonic, antispasmodic, antiperiodic, slows and deepens breathing; solutions protective to wounds. Cardiac and asthmatic dyspnoea, phthisis, shortness of breath, facilitates absorption of oxygen by the blood, causes death by asphyxia; enables the endurance of fatigue, the easy climbing of elevations, etc. Dose, gr. 15–30 (1–2 Gm.); fluid-extract (diluted alcohol), ℥xv–30 (1–2 Cc.); tincture, ʒj–4 (4–15 Cc.).

4. *Quebracho Colorado* (*Loxopterygium Lorentzii*).—S. America. Bark checkered, wood red or light brown (Colorado); contains tannin 20 p. c., loxopterygine; resinous exudation of bark resembles kino. *Quebracho flo'ja* (*Iodi'na rhombifo'lia*), S. America, and *Copalchi Bark* (*Cro'ton ni'veus*), Mexico. All three sometimes collected and sold for *aspidosperma*.

5. *Asclepias tuberosa*, *Asclepias*, *Pleurisy Root*.—Asclepiadaceæ. The dried root, official 1850–1900; United States, Canada. Perennial plant with numerous stems, .6–1 M. (2–3°) high, hairy, green or reddish, differing from other *asclepias* in not emitting milky juice; flowers beautiful orange-red. Root, large, fusiform, in pieces 2.5–15 Cm. (1–6') long, 2.5 Cm. (1') thick, head knotty, annulate, yellowish-brown, fracture tough, uneven, bark thin, wood with large medullary rays; inodorous; taste bitter, acrid; contains asclepiadin—the active glucoside, volatile oil, 2 resins, mucilage, starch, tannin. Diaphoretic, expectorant, carminative, sudorific, anodyne, irritant; large doses emetic, cathartic; pleurisy (hence its name), pneumonia, consumption, rheumatism of chest, colic, dyspepsia, asthma, scrofula, ulcers, wounds. Dose, gr. 15–60 (1–4 Gm.); fluidextract (diluted alcohol) ʒss–1 (2–4 Cc.).

6. *A. incarnata*, *Flesh-colored Asclepias*, *Swamp Milkweed*.—The root (rhizome), official 1820–1860 and 1870–1880. Canada, United States. Perennial herb, smooth or pubescent, .6–1 M. (2–3°) high, with 2 downy lines above; very leafy; leaves lanceolate, cordate base, 10–17.5 Cm. (4–7') long, 2.5–5 Cm. (1–2') wide; flowers rose-purple, sweet-scented; root 2.5 Cm. (1') long, knotty, oblong, brownish, bark thin, central pith, sweet, then acrid bitter, emits milky juice when wounded; contains volatile oil, 2 acrid resins, asclepiadin. Used as alterative, emetic, cathartic, diuretic, like *Asclepias tuberosa*; in decoction, infusion, tincture. Dose, gr. 15–40 (1–2.6 Gm.).

7. *A. syriaca* (*Cornu'ti*), *Common Milkweed*, *Silkweed*.—The root (rhizome), official 1820–1860 and 1870–1880. United States. Herb 1–1.5 M. (3–5°) high, stout, pubescent, finely soft; leaves oblong, 10–20 Cm. (4–8') long, downy beneath; flowers large, purplish-white, sweet-scented, hoods ovate with a tooth each side of stout, claw-like horn; fruit prickly pods containing much silky seed-down; root 2.5–15 Cm. (1–6') long, 6–12 Mm. ( $\frac{1}{4}$ – $\frac{1}{2}$ ') thick, in sections, wrinkled, knotty, brownish; bark tough, thick, with laticiferous vessels, wood-wedges yellow, bitter, nauseous; contains asclepion (tasteless), bitter, crystalline principle, caoutchouc (6 p. c. of milk-juice), resin, tannin, starch. Used like preceding, also to coat over wounds, ulcers, etc., to promote cicatrization. Dose, gr. 15–40 (1–2.6 Gm.).

8. *A. curassavica*, *Bastard Ipecacuanha*.—C. and S. America. Flowers bright red; the glossy seed-hairs, called vegetable silk, are firmer than the preceding; contains asclepiadin. Used natively as do we the *Asclepias tuberosa*.

9. *Marsdenia* (*Gonolobus*) *Conduran'go*, *Condurango*.—Ecuador. Climbing vine, 3–9 M. (10–30°) high, bark of the stem used in medi-

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cine; occurs in quills or curved pieces, periderm ash-gray, wrinkled, warty, with greenish-black lichens attached; liber pale brownish and striate, due to stone-cells; odor slight; taste bitter, acrid; contains tannin, a glucoside, an alkaloid (resembling strychnine in action), resins, starch, gum, ash 12 p. c. Used for tonic, alterative, rheumatism, cancer. Dose, gr. 30 (2 Gm.).

## 69. CONVULVULACEÆ. Morning-glory Family.

Kon-vol-vu-la'se-e. L. *Convolvulus* + aceæ, fr. *convolvere*, to roll together, entwine—i. e., referring to stem's twining habit. Herbs, shrubs. Distinguished by twining or trailing habit, roots containing acrid, milky, purgative juice; leaves exstipulate, sometimes parasitic and leafless; calyx 5, imbricate, inferior; corolla regular, 5-plaited or -lobed; ovary 2-4-celled; ovules 2 in each cell; fruit capsule, 2-4-celled. Allied to Solanaceæ and Scrophulariaceæ, but differing in habit, alternate leaves, and large solitary seeds, with crumpled embryo; tropics, temperate climates; purgative (glucosides in juices); some roots edible (starch, sugar).

Genera: 1. *Exogonium*. 2. *Convolvulus*.

## JALAPA. JALAP.

**Exogonium**  
**purga**, (*Wenderoth*) *Bentham*. { The dried tuberous root, containing 8 p. c.  
of resin, of which not more than 1.5 p. c.  
should be soluble in ether.

*Habitat.* E. Mexico, in damp, rich, shady woods; cultivated in India.

*Syn.* Vera Cruz Jalap, Radix Jalapæ; Fr. Jalap tubéreux, Jalap officinal; Ger. Tubera Jalapæ, Jalapenwurzel, Jalapenknollen, Jalape.

**Ex-o-go'ni-um.** L. fr. Gr. ἐξω, outside, + γένος, offspring—i. e., parts of generation (stamens, pistil) exerted—extend above corolla.

**Pur'ga.** L. fr. *purgo*, *purgare*, to purge, cleanse, purify—i. e., its cathartic action on the system.

**Jal'a-pa.** L. named after *Jalapa* or *Xalapa*, a city in Mexico, whence imported.

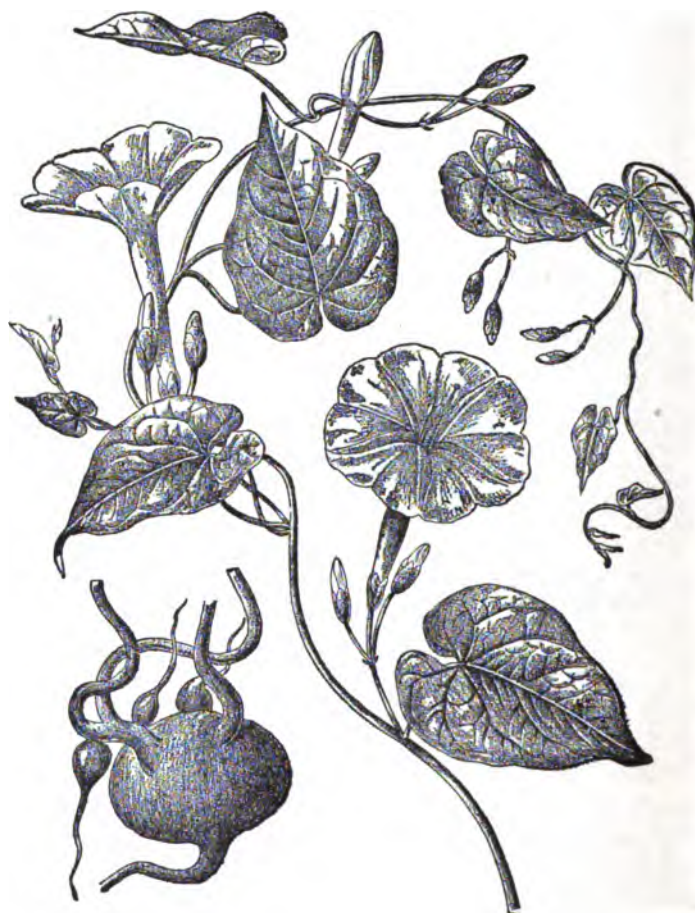
*Jal'ap.* Formerly *jal'op*, English abbreviation from *Jalapa*.

**PLANT.**—Perennial twining herb; stems numerous, slender, twisted, furrowed, smooth, purplish, 3.6-6 M. (12-20°) long, twining around neighboring objects; leaves exstipulate, 10-12.5 Cm. (4-5') long, cordate, entire, smooth, pointed, under side paler, prominently veined, on long petioles; flowers Sept.-Nov., purple, salver-shaped, tube 5 Cm. (2') long, limb 5-7.5 Cm. (2-3') wide, in 3-flowered cymes, stamens exerted (*exogonium*). **ROOT**, napiform, pyriform, or oblong, 2.5-8 Cm. (1-3') long, 1-5 Cm. (½-2') thick, large roots often incised, more or less wrinkled, dark brown, with lighter colored spots, and short transverse ridges, heavier than water, hard, compact, internally dark brown with numerous concentric circles composed of small resin-cells; fracture resinous, lustrous, not fibrous; odor slight, peculiar, smoky, sweetish; taste sweetish, acrid. *Solvents*: diluted alcohol extracts the virtues completely; water or alcohol alone partially; each takes out a

portion of the purgative property, the alcoholic solution being more griping than the aqueous. Dose, gr. 5–20 (.3–1.3 Gm.).

ADULTERATIONS.—1. The roots of allied species. 2. Jalap roots when immature, being collected at improper times (containing very little resin). 3. Jalap roots deprived of resin by soaking in alcohol; all

FIG. 321.

*Exogonium purga.*

such are sticky to the touch, darker internally, hence easily recognized.

4. Roots of many other species of *Exogonium* and *Ipomœa* genera. 5. Mealy jalap, resembling the true root, but has mealy fracture and very few resin-cells.

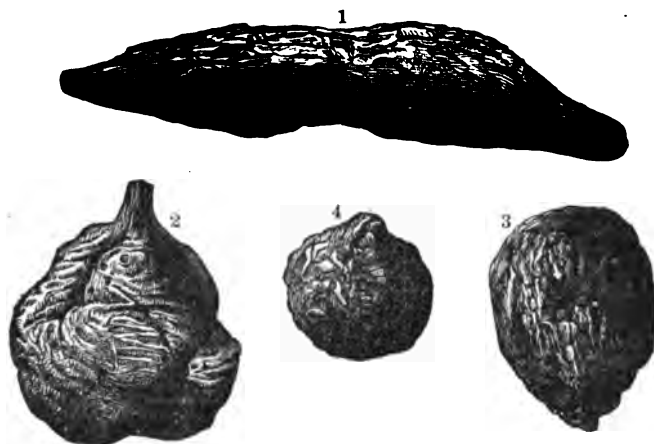
*Commercial*.—Plant grows on eastern slope of Mexican Andes, 1,500–2,400 M. (5,000–8,000°) elevation; it flourishes well in the Neilgherry Mountains, India, and is cultivated in Jamaica. The roots are dug

**CONVOLVULACEÆ.**

all year round (hence the varying appearance and strength), but chiefly in the spring, when the young shoots begin to appear, better in the fall, however, when aerial stems have decayed. They are now washed, put into nets, and dried by holding over fire, there being no sunshine during the rainy season, which imparts a slight smoky odor and hydrates much of the starch; if very large they are divided, incised, before desiccation, into halves, quarters, or transversely, but this form is considered less desirable; after drying they are put into bags (100–200 pounds; 45–90 Kg.), and shipped from Vera Cruz.

**CONSTITUENTS.**—Resin 7–15–22 p. c., starch, gum 15 p. c., sugar 2 p. c., bassorin, coloring matter.

FIG. 322.



Jalap tubers, small sized: 1, fusiform; 2, pear-shaped; 3, date-shaped; 4, globular.

**Resin.**—Consists of: 1. *Jalpin* (probably identical with scammonin), 4–10 p. c., soft, waxy, soluble in ether, alkalis, reprecipitated by acids, and medicinally inert. 2. *Jalapurgin* or *convolvulin*,  $C_{62}H_{100}O_{32}$ , 90–96 p. c., a glucoside, hard, insoluble in ether, soluble in alkalis, more of an irritant than jalapin, and the chief active constituent; converted by alkalis into jalapurgic (convolvul(in)ic acid, which is soluble in water),  $C_{28}H_{52}O_{14}$ , by diluted acids or emulsin into glucose, convolvulic acid, and volatile methyl-ethyl-acetic acid,  $C_5H_{10}O_2$ ; the name jalapin has unfortunately been assigned to both resins.

**Assay:** Exhaust finely powdered drug 10 Gm. with ether until 50 Cc. percolate obtained, evaporate, weight of residue multiplied by 10 = p. c. of ether-soluble resin; continue percolation of same powder (ether-exhausted) with alcohol until 100 Cc. obtained, of this add 20 Cc. to a separator, shake out with chloroform 20, 5, evaporate off chloroform to dryness, weight of residue multiplied by 50 = p. c. ether-insoluble resin; add to this p. c. of ether-soluble resin to get total p. c. of resin present.

**PREPARATIONS.**—1. *Pulvis Jalapæ Compositus*. Compound Pow-

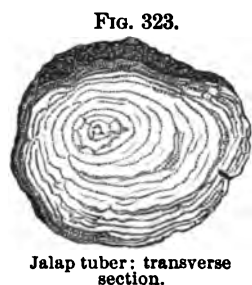


der of Jalap. (Syn., Pulvis Purgans—Catharticus or Jalapæ tartaratus; Fr. Poudre de Jalap composée; Ger. Jalapenpulver mit Weinstein.)

*Manufacture*: 35 p. c. Mix thoroughly 35 Gm. with potassium bitartrate 65 Gm. Dose, gr. 15–60 (1–4 Gm.).

2. *Resina Jalapæ*. Resin of Jalap. (Syn., Br. Jalapæ Resina; Fr. Résine de Jalap; Ger. Jalapenharz.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol q. s. 250 Cc., distil off alcohol 225 Cc., add residue, with constant stirring, to water 300 Cc. to precipitate resin, wash, dry. It occurs in yellow to brown masses or fragments, breaking with resinous, glossy fracture, translucent at edges, or yellowish-brown powder, slight peculiar odor, somewhat acrid taste, permanent, soluble in alcohol, insoluble in carbon



Jalap tuber: transverse section.

disulphide, benzene, fixed and volatile oils; 35 p. c. soluble in chloroform; 10 p. c. in ether—if this ethereal portion be evaporated and residue (jalapin) be dissolved in potassium hydroxide T. S., will get reprecipitation by acids; the portion not soluble in ether (jalapurgin) when dissolved in potassium hydroxide T. S. will not be precipitated by acids. *Test*: 1. Dissolve in 5 times its weight of ammonia water, then acidify with hydrochloric acid, should yield only slight turbidity (abs. of rosin, guaiac, other resins). *Impurities*: Water, rosin (soluble in oil of turpentine), guaiac (green color with few drops of alcohol + ferric chloride T. S.), aloes (very bitter, non-acrid, + nitric acid yielding picric acid), acid resin, soluble and saponifiable substances. Dose, gr. 1–5 (.06–3 Gm.).

*Preps.*: 1. *Pilule Cathartice Compositæ*, resin of jalap  $\frac{1}{2}$  gr. (.02 Gm.).

2. *Pilule Cathartice Vegetabiles*, extract of jalap  $\frac{1}{2}$  gr. (.02 Gm.).

*Unoff. Preps.*: *Extract* (alcohol), dose, gr. 2–10 (.13–.6 Gm.). *Tinctura Jalapæ* (Br.), 15 p. c., dose, ʒss–2 (2–8 Cc.). *Fluidextract*, dose, Mij–10 (.13–.6 Cc.). *Abstract*, dose, gr. 2–5 (.13–.3 Gm.).

**PROPERTIES.**—Hydragogue cathartic, diuretic. Has no effect until the duodenum is reached, where with the bile it forms a purgative compound that stimulates vascularity, peristalsis, and profuse secretion from intestinal glands, with no action on biliary flow; usually acts in 4 hours. It is less irritating than gamboge, podophyllum, or scammony, but occasionally gripes, nauseates, and vomits. Often given to children for worms, as it has little taste and a safe action. Excessive doses produce dangerous hypercatharsis. Jalapurgin (convolvulin) in large doses is likewise an active irritant or poison.

**USES.**—Dropsy, constipation, in febrile and inflammatory affections, head troubles; was introduced into Europe early in the seventeenth century, and is even now quite popular, being combined usually with calomel, cream of tartar, etc.

## CONVOLVULACEÆ.

## Allied Plants:

1. *Ipomœa pandura'ta* (*Convolvulus pandura'tus*), *Wild Potato* or *Jalap*, *Man Root*, *Man of the Earth*.—The root, official 1820–1860. United States. Plant recognized by its fiddle-shaped leaves, stem purplish, climbing 3.5–4.5 M. ( $12-15^{\circ}$ ) high; flowers campanulate, white, purplish; root conical, .6–1 M. ( $2-3^{\circ}$ ) long, 5–7.5 Cm. (2–3') thick, in slices, wrinkled, brownish-yellow, milky inside, bark thin with a zone of resin-cells, odor slight, taste sweetish, bitter, acrid; contains resin 1–2 p. c. (glucoside). Used as diuretic, cathartic in strangury, calculi. Dose, gr. 15–60 (1–4 Gm.).

## False Jalaps:

1. *Ipomœa sim'ulans*, *Tampico Jalap*.—Root irregularly globular or elongated, deeply wrinkled, no transverse ridges; yields resin (tampicin) 10–15 p. c., very similar to jalap resin, nearly all soluble in ether.

2. *I. orizaben'sis*, *Fusiform* or *Male Jalap*.—Root spindle-shaped, .6 M. ( $2^{\circ}$ ) long, large, woody, often cut into pieces 5–7.5 Cm. (2–3') broad, its resin (jalapin or orizabin) entirely soluble in ether. It is unfortunate that the resin of this plant received the name *jalapin* primarily, as it thus precludes in a sense its application to the resin of the official drug. The synonym *orizabin*, as proposed and named by Flückiger, may sometime be accepted here, and thus allow the term *jalapin* to be used more consistently elsewhere.

3. *Convolvulus Mechoacan'na*, *Mechoacanna Root*.—Considered by some identical with *Ipomœa pandurata*; occurs in sections, light, whitish, mealy, contains little resin.

## SCAMMONIUM. SCAMMONY.

*Convolvulus*  
*Scammonia*, Linné. } A gumresin obtained by incising the living root.

*Habitat.* W. Asia (Syria, Asia Minor, Anatolia), Greece (archipelago); cultivated.  
*Syn.* Scammony Virgin, Aleppo Scammony, Scammonium Alepense; Fr. Scammonée; Ger. Scammonium.

*Con-vol'vu-lus.* L. bindweed, see etymology, page 505, of Convolvulaceæ.

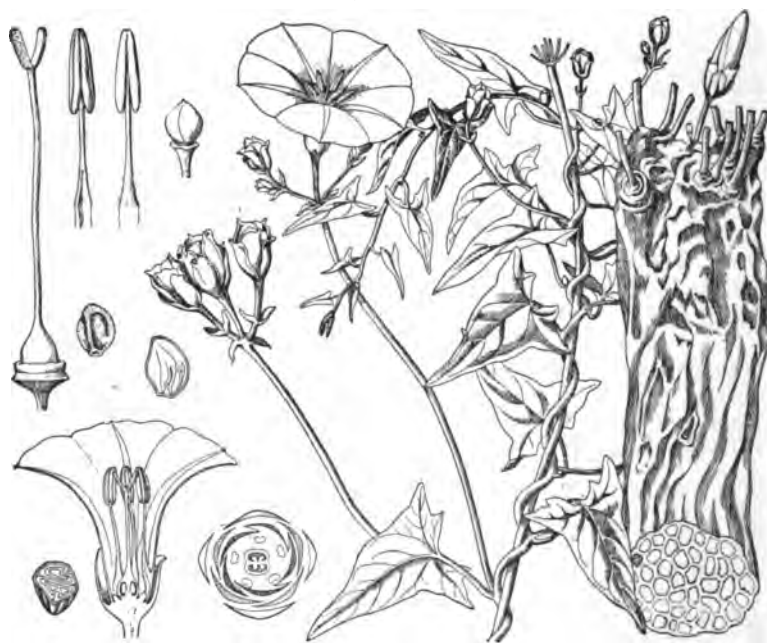
*Scam-mo'ni-a.* L. fr. Gr. σκάμπος, crooked—i. e., its stems are crooked; σκαμνία, classic name, Pers. origin.

**PLANT.**—Perennial herb, root long, perpendicular, straight, tapering, woody, unbranched, 1–1.3 M. ( $3-4^{\circ}$ ) long, 2.5–10 Cm. (1–4') thick, smooth, yellowish, paler within; containing 5 p. c. milky juice; stems numerous, from crown of root, slender, 6–9 M. ( $20-30^{\circ}$ ) long, twining; leaves arrow-shaped, petioles long, bright green; flowers July–Sept.; large, many, on long stalks, funnel-shaped, 4–5 Cm. ( $1\frac{3}{4}-2'$ ) wide, pale yellow; fruit ovate capsule 12 Mm. ( $\frac{1}{2}'$ ) long, 4-seeded. **RESIN** (scammony), in circular cakes or irregular, angular pieces of various sizes, greenish-gray or brownish-black, often covered with grayish-white powder, very brittle, fracture angular, porous, resinous lustre, internally uniform brownish-black, more or less translucent in

thin fragments; odor peculiar, somewhat cheese-like; taste slightly acid; it is easily reduced to ash-gray powder, triturated with water yields greenish emulsion. *Tests*: 1. Does not effervesce with diluted hydrochloric acid; cold decoction does not become blue with iodine T. S. (abs. of calcium carbonate, starch). 2. Alcoholic solution not colored blue by tincture ferric chloride; at least 75 p. c. soluble in ether, and residue from evaporating ethereal solution dissolved in potassium or sodium hydroxide solution is not reprecipitated by diluted sulphuric acid. *Solvents*: boiling alcohol dissolves most of it. Dose, gr. 1–5–10 (.06–3–.6 Gm.).

**ADULTERATIONS.**—Calcium carbonate, wheat flour, starch, ashes, sand, tragacanth, powdered scammony root, rosin, gypsum, black-lead, exhausted gumresin, also that of guaiac and other resins—all insoluble

FIG. 324.



*Convolvulus Scammonia*: a, blooming plant; b, fruiting twig; c, root ( $\frac{1}{4}$  natural size); also flower, anther, pistil, fruit, seed, diagram of flower, enlarged.

in ether, hence by amount of ether-residue can readily determine the extent of impurities; resin extracted from dried root may be recognized by peculiar leathery odor; "skillip" is made of damaged flour or some similar material; resin extracted from root of *Convolvulus althæoides*.

**Commercial.**—Scammony is collected June–Aug., when plant is in flower, by removing upper earth from top of root 7.5–12.5 Cm. (3–5') deep, and cutting a slanting cross-section 2 inches (5 Cm.) below the crown with a sickle knife, whereupon the juice at once exudes, being

## CONVOLVULACEÆ.

caught in mussel shells stuck in the root below; this pure resin when dry is gummy-looking, golden-yellow color, and each plant yields about 1 drachm (4 Gm.). The shells are collected at evening and the plastic tears scraped from cut surface of the root; this latter has a creamy consistence (*kaimak*), that in shells milky (*gala*). As thus obtained we have the purest variety: 1. *Genuine Scammony*, *Scammony in Shells*; usually, however, before reaching market, this is kneaded with water or expressed juice of leaves, stalks, or roots, then quickly dried, and thus furnishes an inferior grade: 2. *Virgin Scammony*. Formerly *Aleppo* was known as superior and *Smyrna* as inferior, while now the converse is often true, so that the only safe determination of quality turns upon the percentage yield of resin. 3. *Montpellier* or *Factitious Scammony* is the milky juice of *Cynanchum acutum* (*monspeliacum*), used somewhat in France; contains resin 10–20 p. c., starch 50–60 p. c., earthy substances 11–18 p. c., and is imported sometimes as *Smyrna*. The *virgin* variety as prepared (consisting of daily collections until aggregating a pound (.5 Kg.) or more) requires a long time, during which the exudation slowly dries, allowing fermentation to take place, and thus renders the product porous, dark, and of a cheesy odor; the *genuine*, on the other hand, is apt to become mouldy and covered with white crystalline efflorescence; to avoid this, must keep dry. Enters market via *Smyrna*.

CONSTITUENTS.—Resin (scammonin) 75–90 p. c., gum 3–8 p. c., ash 3–8 p. c.

Resin,  $C_{34}H_{56}O_{16}$ .—Identical with orizabin (jalapin of *Ipomœa orizabensis*); is an ether-soluble glucosidal resin—the anhydride of scammonic acid, into which it is converted by alkalies, a substance soluble in water.

PREPARATIONS.—1. *Resina Scammonii*. Resin of Scammony. (Syn., Scammonin; Br. Scammonia Resina; Fr. Résine de Scammonée; Ger. Scammoniaharz.)

*Manufacture*: Digest 100 Gm. with successive portions of boiling alcohol until exhausted, mix liquids, filter, distil off alcohol, add syrupy residue, constantly stirring, to water 250 Cc. to precipitate resin, wash, dry. It is in yellowish-brown masses or fragments, glossy, resinous fracture, translucent at the edges, or grayish-white powder, faint characteristic odor, slight peculiar taste, soluble in alcohol, oil of turpentine, ether, chloroform; dissolves in ammonia water and solutions of alkalies with gentle heat, from which not reprecipitated by acids. *Tests*: 1. Stirred with equal weight sulphuric acid should not gradually turn red (abs. of rosin); ash 1 p. c. 2. Does not yield green emulsion with water (abs. of scammony). Dose, gr. 3–8 (.2–.5 Gm.).

Prep.: 1. *Extractum Colocythidis Compositum*, 14 p. c. (resin).

*Unoff. Preps.*: *Pihula Scammonii Composita* (Br.), resin + jalap resin, each 16 p. c., dose, gr. 4–8 (.26–.5 Gm.). *Pulvis Scammonii Compositus* (Br.), resin 50 p. c. + jalap 37.5, ginger 12.5, dose, gr. 10–20 (.6–1.3 Gm.). *Emulsion*. In pill-form usually inactive, unless in combination.

PROPERTIES.—Hydragogue, cholagogue cathartic; only acts locally

on the upper intestine, consequently resembles jalap, but is a more active irritant, causing much griping, owing to which it is combined generally with potassium sulphate, calomel, colocynth, jalap, aromatics, demulcents, etc.

USES.—Dropsies, cerebral affections, torpid intestines with slimy mucus. It is somewhat uncertain in action, owing to frequent impurities and difficult solubility in the system, yet the small dose and slight taste commend it for administration to children; but at all times calomel, jalap, or gamboge is to be preferred. It was known to the Greeks, Romans, and Arabians as a purgative, remedy for skin diseases, and as a fatal irritant.

*Poisoning*: Same as for aloes, colocynth, etc.

#### 70. HYDROPHYLLACEÆ. Waterleaf Family.

Hi-dro-fil-la'se-e. L. *Hydrophyllum* + aceæ, fr. Gr. ὕδωρ, water, + φύλλον, L. *folium*, a leaf—i. e., each leaf has a cavity for holding water. Herbs, shrubs, small trees. Distinguished by being hairy, juicy; leaves hairy, toothed, lobed, pinnately compound; flowers regular, scorpioid, 5's; ovary 1–2-celled, 2 parietal placentas, styles and stigmas 2; ovules 2—many; fruit, capsule, 2-valved; temperate climates; stimulant, astringent.

Genus: 1. **Eriodictyon**.

#### ERIODICTYON. ERIODICTYON.

**Eriodictyon**  
**californicum**, (Hooker et Arnott) Green. } The dried leaves.

*Habitat*. California, Northern Mexico; dry hills, mountains.

*Syn*. Yerba Santa, Bear's, Consumptive's or Tar Weed, Mountain Balm, Gum Plant, Gum-bush.

**Er-i-o-dic'ty-on**. L. fr. Gr. ἐριον, wool, + δίκτυον, a net—i. e., woolly, net-veined leaves.

**Cal-i-for'ni-cum**. L. *californicus*, Californian, of or belonging to California—i. e., its habitat.

**PLANT**.—Evergreen shrub, 1–1.5 M. (3–5°) high, growing among rocks; stem smooth, resinous; flowers 12 Mm. ( $\frac{1}{2}$ ') long, funnel-shaped, purple or white, racemes. **LEAVES**, oblong-lanceolate, 5–15 Cm. (2–6') long, 1–3 Cm. ( $\frac{2}{5}$ – $1\frac{1}{5}$ ') broad, acute at apex, narrowed below into short broad petiole, margin somewhat incurved, irregularly serrate or crenate-dentate, upper surface yellowish-green, smooth, covered with brownish resin (varnished), lower surface yellowish-white, conspicuously reticulated, densely tomentose; brittle, flexible in damp, warm atmosphere; odor somewhat aromatic; taste balsamic, sweetish; usually occur in fragments. *Solvent*: alcohol (80 p. c.). Dose, 3ss–1 (2–4 Gm.).

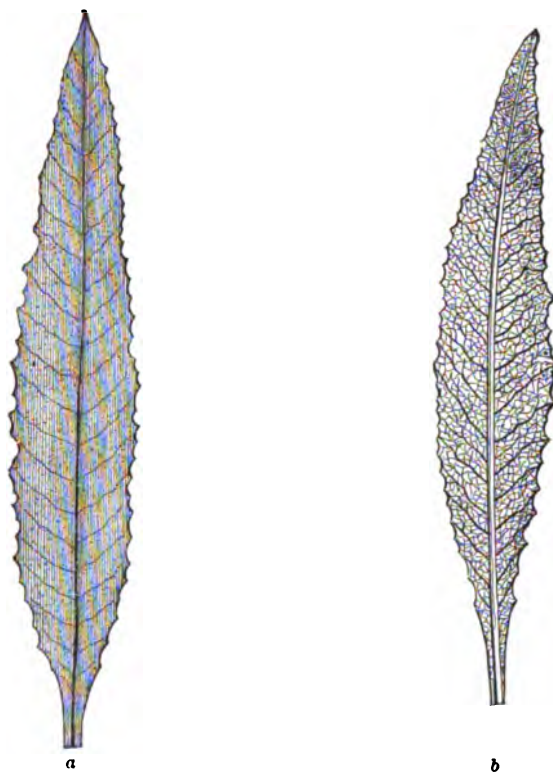
**CONSTITUENTS**.—Volatile oil, bitter acrid resin 9 p. c., inert resin, sugar, eriodictyonic (eriodictic) acid,  $C_{14}H_{18}O_5$ , 2.4 p. c., ericolin,  $C_{34}H_{56}O_{21}$ .

**HYDROPHYLLACEÆ.**

**PREPARATIONS.**—1. *Fluidextractum Eriodictyi*. Fluidextract of Eriodictyon. (Syn., Extractum Eriodictyi Fluidum, U. S. P. 1890, Fluidextract of Yerba Santa; Fr. Extrait liquide d'Eriodictyon; Ger. Flüssiges Eriodictyonextrakt.)

*Manufacture:* Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv-60 (1-4 Cc.).

FIG. 325.



Eriodictyon leaves, natural size: a, upper surface; b, under surface.

*Unoff. Preps.:* *Syrup* (made like syrup of tolu, has pineapple odor and taste). *Aromatic Syrup* (fluidextract of eriodictyon 3.2 Cc., potassium hydroxide solution 2.5, compound tincture of cardamom 6.5, oil of sassafras .05, oil of lemon .05, oil of cloves .01, alcohol 3.2, sugar 80 Gm., water q. s. 100 Cc.); dose, ʒj-2 (4-8 Cc.). *Extract*, dose, gr. 2-10 (.13-.6 Gm.).

**PROPERTIES.**—Stimulating expectorant, bitter tonic.

**USES.**—Bronchitis, asthma, to disguise bitterness of quinine.

*Allied Plant:*

1. *Eriodictyon tomento'sum*.—Grows along with official, and differs in being larger and in having a dense coat of short villous hairs, which become whitish or rust-colored by age; corolla salver-form; leaves oval, obtuse.

## 71. LABIATÆ. Labiate (Mint) Family.

**La-bi-a'te.** L. *Labi-um(-a)* + *atæ*, fem. pl. of *labiatus*, lip, lips, lipped—*i. e.*, referring to the irregular or lipped corolla. Herbs, shrubs. Distinguished by abounding in aromatic, stimulant, volatile oils, bitter extractive; stems square, calyx regular, 2-lipped, 5-toothed, corolla irregular, 2-lipped, 4–5-lobed, stamens 4, didynamous, or by abortion 2; leaves opposite, aromatic; ovary 4-lobed, becoming in fruit 4 seed-like monospermous nutlets or achenes, enclosed by persistent calyx; temperate climates; aromatic, carminative, stimulant (vol. oil), tonic, stomachic (bitter extractive principle), flavoring, perfumery.

Genera: 1. *Scutellaria*. 2. *Marrubium*. 3. *Salvia*. 4. *Hedeoma*. 5. *Thymus*. 6. *Mentha*. 7. *Lavandula*. 8. *Rosmarinus*.

## SCUTELLARIA. SCUTELLARIA.

**Scutellaria**  
**lateriflora**, (Linné). } The dried plant.

**Habitat.** N. America, west to Alabama, New Mexico, Oregon, in damp thickets, sides of ditches.

**Syn.** Skullcap, Blue Skull Cap or Pimpernel, Hooded Willow Herb, American or Side-flowering Skull Cap, Mad Dogweed, Hoodwort, Mad Weed, Helmet Flower. Fr. Scutellaire. Ger. Helmkraut, Schildkraut.

**Sou-tel-la'ri-a.** L. *scutella*, a small vessel—*i. e.*, the resemblance of the calyx.

**Lat-er-i-flō'ra.** L. *latus*, *lateris*, side + *flos*, *floris*, flower—*i. e.*, flowers grow in long, lateral (only on one side), leafy racemes.

**Skull'cap**—*i. e.*, the inverted cup calyx appears like a helmet with the visor raised, and after flowering closes upon seed as a cap, hence like cap fitting the skull.

**PLANT.**—Perennial herb; stem erect, branched, .3–.6 M. (1–2°) high, smooth, quadrangular; leaves opposite, 5 Cm. (2') long, ovate-lanceolate, or ovate-oblong, acuminate, serrate, petiolate; flowers July–Aug., 6 Mm. (¼') long, in one-sided, axillary, leafy racemes, with a pale blue corolla and bilabiate calyx, closed in fruit, upper lip helmet-shaped; odor slight; taste bitter. **Solvents:** diluted alcohol; boiling water. **Dose,** 3ss–1 (2–4 Gm.).

**CONSTITUENTS.**—Scutellarin, volatile oil, tannin, sugar, ash 14 p. c.

**Scutellarin**,  $C_{10}H_8O_3$ .—This is a crystalline bitter principle or glucoside, in flat yellow needles, soluble in alcohol, ether. **Dose,** gr. ½–4 (.03–.26 Gm.). The *scutellarin* of the "Eclectics" is not a pure proximate principle, as it is obtained by throwing the concentrated alcoholic tincture into water to which alum has been added, then washing and drying the precipitate.

**PREPARATIONS.**—1. *Fluidextractum Scutellariæ*. Fluidextract of Scutellaria. (Syn., Extractum Scutellariæ Fluidum, U. S. P. 1890, Fluidextract of Skullcap; Fr. Extrait liquide de Scutellaire; Ger. Flüssiges Helmkrautextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. **Dose,** 3ss–1 (2–4 Cc.).

**Unoff. Preps.:** *Decoction*, 5 p. c., dose, 3j–2 (30–60 Cc.). *Extract*, dose, gr. 5–10 (.3–.6 Gm.).

## LABIATE.

PROPERTIES.—Tonic, nervine, antispasmodic.

USES.—Epilepsy, hysteria, nervous exhaustion, chorea, delirium tremens, tremors, spasms, twitching of muscles, hyperæsthesia, neuralgia, convulsions, intermittents; incontinence of urine, hydrophobia.

*Allied Plants:*

1. *S. integrifolia* (plant hairy, racemes terminal). *S. pilo'sa* (plant hairy, racemes terminal, leaves in distant pairs), and *S. galericula'ta* (plant nearly smooth, flowers axillary, single). All used like official drug.

## MARRUBIUM. MARRUBIUM.

**Marrubium** }  
**vulgare, Linné.** } The dried leaves and flowering tops.

*Habitat.* Europe, C. Asia; naturalized in N. America; cultivated in waste places, gardens, etc.

*Syn.* Horehound, White Hoarhound, Houndbene, Marrube, Marvel, Herba Marrubii; Fr. (Herbe de) Marrube blanc; Ger. Andornkraut, Weisser Andorn.

**Mar-ru'bi-um.** L. (Pliny) fr. Heb. *marrob*, bitter juice—i. e., the plant's extreme bitterness.

**Vul-ga're.** L. *vulgaris*, common, ordinary—i. e., kind growing wild, and in general use, not cultivated.

*Hore'hound.* OE. *horehune*, AS. *harhune*; *har*, hoar, gray, + *hune*, horehound = gray horehound, stem and branches covered with white felt.

**PLANT.**—Perennial herb with short rootstock; stems numerous, annual, .3–.5 M. (12–18') high, branched below, bluntly quadrangular, tomentose, with cottony felt. **LEAVES**, 1.5–5 Cm. ( $\frac{3}{8}$ –2') long, opposite, petiolate, roundish-ovate, obtuse, coarsely crenate, strongly rugose-veined, more or less white-hairy, especially underneath; flowers June–Sept., in dense axillary whorls, with a 10-toothed calyx, the divisions slightly unequal, erect-spreading, pungent; corolla small, whitish, bilabiate, 4 included stamens; fruit of 4 ovoid, obtuse, nearly smooth nutlets, 1.5 Mm. ( $\frac{1}{16}$ ') long; odor distinct, rather agreeable; taste somewhat aromatic, bitter. *Solvents*: diluted alcohol; boiling water. Dose, ʒss–1 (2–4 Gm.).

**ADULTERATIONS.**—A spurious marrubium is supplied to the trade having leaves only half the size of official, thinner, less rugose, and 5 calyx-teeth much smaller or wanting.

**CONSTITUENTS.**—Volatile oil, Marrubiin, resin, tannin, fat, wax, sugar, gum, albumin, salts.

**Marrubiin.**—Bitter glucoside, crystallizing from alcohol in prisms, from ether in tabular crystals, not precipitated by tannin, bitter, acrid taste; obtained by treating aqueous extract with alcohol, distilling, shaking residue with ether; or may agitate infusion with charcoal and exhaust this with hot alcohol, which dissolves marrubiin and tannin, precipitate latter with lead oxide.

**PREPARATIONS.**—(Unoff.) *Fluidextract*, dose, ʒss–1 (2–4 Cc.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.). *Juice (Succus Marrubii)*, dose, ʒj–2 (4–8 Cc.), given with honey or milk. *Extract*, dose, gr. 5–10 (.3–.6 Gm.).



**PROPERTIES.**—Stimulant, tonic, bitter stomachic, resolvent, deobstruent, anthelmintic. Large doses diuretic, diaphoretic, laxative.

**USES.**—Dyspepsia, bronchitis, chronic hepatitis, jaundice, amenorrhœa, phthisis, cachectic affections, catarrh, chronic rheumatism, intermittents. The infusion may be sweetened or flavored to liking; owing to its bitterness, the lozenges or cough drops are the most popular form of administration.

*Allied Plants:*

1. *Nep'eta Cata'ria*, *Catnep*, *Catnip*, *Catmint*.—The dried leaves and flowering tops, official 1840–1880. Asia, Europe; naturalized in United States. Perennial herb; stem quadrangular, branching, hoary, pubescent, .6–1 M. (2–3°) high, leaves 5 Cm. (2') long, triangular, ovate, cordate, serrate, hairy, flowers whitish or pale pink, dotted with lilac, calyx 5-toothed, 2-lipped, stamens 4, didynamous, odor mint-like, bitter, aromatic, camphoraceous, pungent; contains volatile oil, bitter principle, tannin. Used as carminative, stimulant, tonic, diaphoretic, emmenagogue, antispasmodic for hysteria, chlorosis, colic, amenorrhœa, toothache; in infusion, decoction. Dose, gr. 15–60 (1–4 Gm.). Cats eat it ravenously, being fond of it because of its aphrodisiac effect.

2. *Prunel'la (Brunel'la) vulga'ris*, *Self-heal*, *Heal-all*. Plant .3 M. (1°) high, flowers purplish-blue, in dense spike, leaves hairy, bitter, astringent.

## SALVIA. SALVIA.

**Salvia**  
**officinalis**, Linné. } The dried leaves.

**Habitat.** S. Europe, warm stony places; cultivated in England, France, Germany, Spain, Italy, Greece, United States, in gardens.

**Syn.** Sage, Garden Sage, Meadow Sage of Europe; Fr. Sauge officinale, Sauge; Ger. Folia (Herba) Salvia, Salbeiblätter, Salbei.

**Sal'vi-a.** L. fr. *salvo*, *salvare*, to save—i. e., its supposed healing properties.

**Of-fi-ci-na'lis.** L. see etymology of (*Asagraea*) *officinalis*, page 101.

**Sage.** OE. *sauge*, L. *salvia*, *salvus*, saved—i. e., its healing virtues.

**PLANT.**—Perennial; stem semi-shrubby, .6 M. (2°) high, quadrangular, pubescent, much branched; flowers June, large, on woolly stalks, blue variegated with white and purple, cymes, calyx tubular, striated, 2 lips, upper with 3, the lower 2 acute teeth; corolla tubular, bilabiate, lower in 3 rounded lobes, middle one the largest; fruit 4 achenes, seed solitary. **LEAVES**, long and stoutly petiolate, blade elliptical or ovate-oblong, 3–7 Cm. (1½–3') long, obtuse or subacute at apex, rounded or subcordate at base, finely crenulate, thick, grayish-green, very pubescent, especially under surface, conspicuously reticulate-veined; odor aromatic; taste aromatic, bitter, somewhat astringent. Should be collected by hand while flowering and carefully dried in the shade; for distillation the entire plant is cut down, which is often carelessly dried, "Italian Baled Sage," and substituted for official product; sage leaves also come in large bales. **Solvents:** diluted alcohol; boiling water. Dose, gr. 15–60 (1–4 Gm.).

## LABIATÆ.

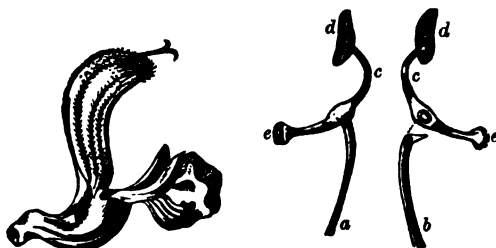
CONSTITUENTS.—Volatile oil 0.5–2 p. c., resin, tannin, bitter principle, gum.

Volatile Oil.—Obtained by distillation with water or steam, is greenish or yellowish, sp. gr. 0.920, soluble in alcohol (80 p. c.), dextrogyrate. Composed of terpene—pinene,  $C_{10}H_{16}$ , cineol,  $C_{10}H_{18}O$ , as the first and lesser portion, and salviol (thujone),  $C_{10}H_{16}O$ , as the greater portion; in fresh oil the converse is true,

FIG. 326.

*Salvia officinalis*.

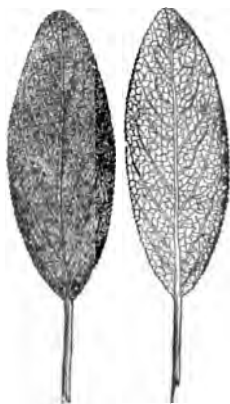
FIG. 327.

*Salvia officinalis*, flower: a, b, filaments; c, connective; d, fertile anthers; e, sterile anthers.

terpenes predominate, and by age salviol increases, thus developing camphor.

PREPARATIONS.—(Unoff.) *Fluidextract*, dose, ℥xv–60 (1–4 Cc.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.). *Water* (*Aqua Salviæ*), distil 1 part + water 10. *Gargle*.

FIG. 328.



Sage leaf: a, upper surface; b, lower surface.

FIG. 329.

*Monarda punctata*: flower magnified.

PROPERTIES.—Stimulant, tonic, astringent, vulnerary, condiment.

USES.—Ancients valued it highly for its recognized properties. At present mainly used as a condiment in seasoning fat fowl, pork, for

dyspepsia, colliquative sweats. Externally—infusion in ulcers of mouth, throat; dries up mammary secretion, indurated sores, nasal catarrh. Gargle may be sweetened with sugar, honey, and have added to it vinegar, alum, borax, potassium chlorate, etc.

*Allied Plants:*

1. *Salvia pratensis*.—S. Europe, *S. lyrata*, N. America—slightly aromatic, and *S. polystachya*, Chia-seed, Mexico. All these are aromatic, bitter, and may be used like official. Infusions of all species, if taken hot produce and if cold check excessive sweating.

2. *Monarda punctata*, Horse-mint.—The leaves and tops, official 1820–1880. United States. Perennial, .6–1 M. (2–3°) high, stem branched, downy, leaves 5–7.5 Cm. (2–3') long, lanceolate, serrate, punctate, flowers yellow, spotted red with pinkish bracts, downy, calyx 5-toothed, aromatic, pungent, bitter; contains volatile oil. Used as carminative, stimulant, emmenagogue, nervine, diaphoretic, diuretic, for flatulent colic, nausea, rheumatism, neuralgia, diarrhoea; in infusion. Dose, gr. 15–60 (1–4 Gm.).

*Oleum Monardæ* (volatile oil), official 1820–1880. It is yellow or red, sp. gr. 0.930, contains terpene,  $C_{10}H_{16}$ , 50 p. c., thymol (monardin),  $C_{10}H_{14}O$ , 25–61 p. c., also alcohol,  $C_{10}H_{18}O$ , and its acetic, butyric, and formic esters.

## HEDEOMA. HEDEOMA.

**Hedeoma**  
**pulegioides**, (Linné) Persoon. } The dried leaves and flowering tops.

*Habitat.* N. America, New England, Dakota, southward to Georgia, etc.

*Syn.* American Pennyroyal, Pennyroyal, Squaw Mint, Tick or Thick Weed, Stinking Balm; Fr. Herbe de Pouliot américain; Ger. Amerikanischer Polei.

**He-de-o'ma.** L. fr. Gr. ἡδίσ, sweet, + ὀσμή, smell, referring to its smell, altered from *Hedysmum*, Gr. ἡδίσσμον, named by Theophrastus.

**Pu-leg-i-oïdes.** L. fr. Gr. ψύλλιον, L. *pulegium*, fleabane, + ο-είδης, L. *oides*, like or resembling, = *pulex*, pl. *pulices*, flea, fleas—pulegium-like Hedeoma—i. e., has the appearance and odor similar to European pulegium.

*Pen-ny-roy'al.* Altered from *puliol-royal*, penny now used for obsolete *puliol*, *pulex*, a flea, + *regium*, royal—i. e., royal against fleas, mosquitoes, etc.

**PLANT.**—An annual growing in barren, sandy fields, hills, open woods, dry places, scenting afar the surrounding air with its odor; stem 25–37.5 Cm. (10–15') high, quadrangular, pubescent, with many slender erect branches, root yellowish, fibrous. **LEAVES**, opposite, short-petioled, 15–35 Mm. ( $\frac{3}{8}$ –1 $\frac{1}{2}$ ') long, thin, obtuse, obscurely serrate, glandular-hairy beneath; branchlets quadrangular, with many spreading hairs; flowers June–Aug., axillary fascicles, with tubular-ovoid bilabiate, 5-toothed calyx and pale blue, spotted, bilabiate corolla, containing 2 sterile and 2 fertile exserted stamens; odor strong, mint-like, taste aromatic, pungent. *Solvents:* alcohol; boiling water partially. Dose, gr. 15–60 (1–4 Gm.).

**CONSTITUENTS.**—Volatile oil 1 p. c., bitter principle, tannin.

**Oleum Hedeomæ.** Oil of Hedeoma, *official*.—(Syn., Oil of American Pennyroyal; Fr. Essence de Pouliot américain; Ger. Ameri-

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kanisches Poleiöl.) This volatile oil, distilled from the leaves and flowering tops of hedeoma with water or steam, is a yellowish, limpid

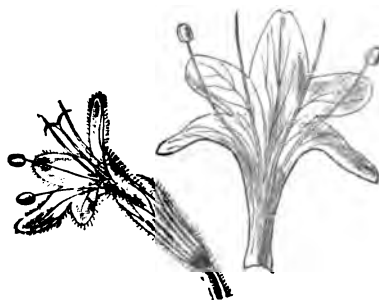
FIG. 330.

*Hedeoma pulegioides.*

liquid, characteristic, pungent, mint-like odor and taste, sp. gr. 0.930, soluble (clear) in 2 volumes 70 p. c. alcohol, dextrogyrate; contains hedeomol,  $C_{10}H_{18}O$ , 33 p. c. (this is a ketone, and its highest boiling portion is menthone), also pulegone,  $C_{10}H_{16}O$ , formic, acetic, and isoheptoic acids. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{m}\text{j}$ –10 (.13–.6 Cc.).

PREPARATIONS. — (Unoff.) *Fluidextract* (diluted alcohol), dose,  $\mathfrak{z}\text{ss}$ –2 (2–8 Cc.). *Infusion*,

FIG. 331.

*Hedeoma pulegioides*: flower and corolla, magnified.

5 p. c., dose,  $\mathfrak{z}\text{ij}$  (60 Cc.) every hour. *Spirit* (oil 1 + alcohol 9), used externally or in spray.

PROPERTIES.—Stimulant, carminative, emmenagogue, aromatic.

USES.—Flatulent colic, nausea, indigestion, to correct nauseating and griping purgatives. In hot infusion to dissipate the congestion of diarrhœa, bronchial inflammation, muscular rheumatism, also taken with hot hip and foot baths in amenorrhœa. The odor is very repulsive to insects (fleas, mosquitoes, etc.); hence the generic and specific names. The oil or spirit sprayed around or applied to cloths and laid about a room suffices to drive such pests away. In excessive doses for suppressed menses or for inducing abortion, death has occurred from narcosis. Oil often added to liniments as rubefacient.

*Allied Plants:*

1. *Men'tha Pule'gium*, *European Pennyroyal*.—Resembles official; leaves oval, serrate, flowers in cymes, purplish, corolla 4-lobed. *Hedeoma piperi'ta*, Mexico—used for peppermint, and *H. thymoi'des*, Texas—odor more agreeable; used as aromatic, diaphoretic.

2. *Melissa officinalis*, *Melissa*, *Balm*.—The leaves and tops, official 1840–1900; Asia Minor; S. Europe. Perennial herb with fragrance of lemons, growing in waste places; stems several, quadrangular, .3–1 M. ( $1-3^{\circ}$ ) high, branched at base, pubescent; flowers yellowish-white, purplish, calyx 5-toothed, tubular, bell-shaped; corolla bilabiate, 4 stamens. Leaves, 5 Cm. (2') long, petiolate, ovate, obtuse, crenate, hairy, glandular, branches square; fragrant, aromatic, astringent, bitter; contains volatile oil 0.25 p. c., bitter principle, tannin, gum; solvents: diluted alcohol, boiling water. Carminative, diaphoretic, stimulant, antispasmodic. Used as a refreshing drink; when cold for febrile affections, when hot acts slightly on the skin. Dose, gr. 15–60 (1–4 Gm.); water (aqua melissæ), leaves 1 part, distil with water 10 parts; compound spirit (spiritus melissæ compositus), balm 14 + lemon peel 12, nutmeg 6, cinnamon 3, cloves 3, alcohol 150, water 250, distil 200 parts; fluidextract, Mxv–60 (1–4 Cc.); infusion, 3j–2 (30–60 Cc.); oil, Mj–2 (.06–.13 Cc.).

3. *Hyssopus officinalis*, *Hyssop*.—S. Europe. Plant .3 M. ( $1^{\circ}$ ) high, stem square, leaves 2.5 Cm. (1') long, punctate on both sides, flowers purplish-blue, stamens 4, exserted; contains volatile oil  $\frac{1}{2}$  p. c., bitter principle, resin, fat. Used in Biblical times as a cathartic, now as a carminative, stimulant, sudorific; for dyspepsia, amenorrhœa,

FIG. 333.

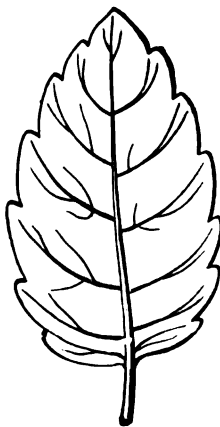
*Melissa officinalis*: leaf.

FIG. 332.

*Melissa officinalis*: flower and corolla, magnified.

rheumatism, bruises, bronchitis, sore throat, chronic catarrhs. Dose, gr. 15–60 (1–4 Gm.), in infusion, 5 p. c.; or oil, Mj–2 (.06–.13 Cc.).

4. *Origanum vulgare*, *Wild Marjoram*.—The herb, official 1820–1860 and 1870–1890. Asia, Europe, N. Africa, naturalized in N. America. Perennial herb, .3–.5 M. (12–18') high; stem square, purplish, downy; leaves 2.5 Cm. (1') long, ovate, entire, pellucid-punctate, hairy beneath, flowers pale purple, calyx 5-toothed, corolla 2-lipped, 4 exserted didynamous stamens, aromatic, pungent, bitter; contains volatile oil 1 p. c., bitter principle, resin, tannin. *Oleum*

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*Origani*, official 1820–1860 and 1870–1880; consists mainly of terpene,  $C_{10}H_{16}$ . Used as carminative, stimulant, emmenagogue, diaphoretic, tonic, fomentation, for dyspepsia, indigestion, nausea, colic, rheumatism, neuralgia; in infusion. Dose, gr. 15–60 (1–4 Gm.). Oil used in liniments, carious teeth, flatulence. Dose,  $\mathfrak{M}$ v–10 (.3–.6 Cc.).

The closely allied *Origanum Majorana*, *Sweet Marjoram*, is cultivated largely, and is used as a condiment in cooking.

**THYMUS. THYME.**

**Oleum Thymi.** Oil of Thyme, *official*.

**Thymus vulgaris**, *Linné.* } A volatile oil distilled from the leaves and flowering tops.

*Habitat.* S. Europe (Portugal to Greece); cultivated in gardens, etc.

*Syn.* Common Garden Thyme, Mother of Thyme; Fr. Herbe Thym, Huile volatile (Essence) de Thym; Ger. Herba Thymi, Thymian, Thymianöl.

**Thymus.** L. fr. Gr. *θυμός*, strength, its invigorating smell. Used in temples as incense.

**Vul-ga-ris.** L. ordinary, common, the kind growing wild and in common use.

**PLANT.**—Small shrub, 25–30 Cm. (10–12') high; stem and branches quadrangular; bark pale brown, shoots purplish; leaves 6–12 Mm. ( $\frac{1}{4}$ – $\frac{1}{2}$ ') long, oval, blunt, entire, margin revolute, thick, smooth, dotted with many oil-glands, paler, pubescent beneath; flowers June–July, polygamous, cymes, forming capitate heads, pale purple. Entire plant aromatic, peculiarly attractive to bees, flies, etc.

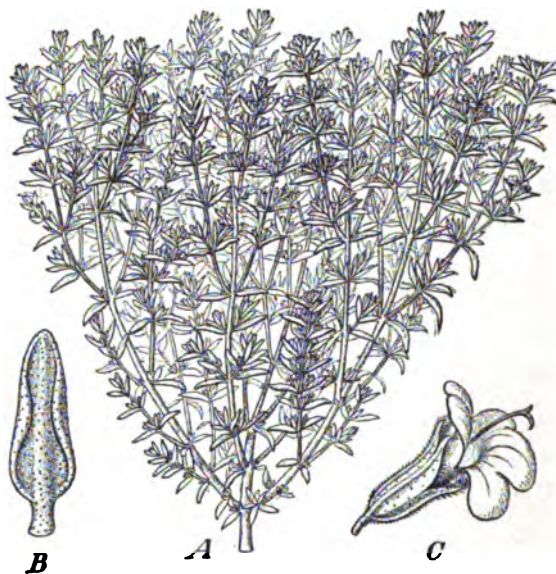
**CONSTITUENTS.**—Volatile oil 2.5 p. c. (thymol), tannin, gum.

**Oleum Thymi.** Oil of Thyme.—A colorless liquid, strong odor of thyme, aromatic, pungent, afterward cooling taste, darker and thicker by age, sp. gr. 0.915, soluble in  $\frac{1}{2}$  volume alcohol, 1–2 volumes 80 p. c. alcohol, levogyrate; contains at least 20 p. c., by volume, of phenols; this phenol content in the French and German oil (25–42 p. c.) is mostly thymol; sometimes, however, carvacrol or a mixture of both; in the Spanish oil (50–70 p. c.) it is carvacrol; also are present cymene  $C_{10}H_{14}$ , *l*-pinene, borneol, and linalool. *Tests*: 1. Oil + 1 drop ferric chloride T. S. gives greenish-brown color, changing to red. 2. Oil 1 Cc. + hot water 10 Cc., shake, cool, filter, + 1 drop ferric chloride T. S. to the filtrate, should not produce bluish or violet color (abs. of phenol). *Assay*: Oil 10 Cc. + 20 Cc. solution sodium hydroxide (1 in 20) in a 50 Cc. burette, graduated in tenths, shake, set aside 12–24 hours; after alkaline solution clear, note volume of non-phenol oil remaining (which should not be more than 8 Cc.), subtract this from 10 Cc. oil originally taken, the difference multiplied by 10 = p. c. of phenols in the oil. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\mathfrak{M}$ j–5 (.06–.3 Cc.).

**ADULTERATIONS.**—Oil of turpentine, which lowers specific gravity, increases angle of rotation; wild thyme oil only increases angle of rotation.

**Thymol.** Thymol,  $C_{10}H_{14}O$ .—(Syn., Acidum Thymicum, Thymic Acid, Methyl-propyl phenol; Fr. Acide Thymique; Ger. Thymolum, Thymiansäure.) This monatomic phenol occurs in the volatile oils of *T. vulgaris*, *Monarda punctata*, and *Ptycho'tis Cop'tica* (Umbelliferae), also probably in some other volatile oils of Labiatae and Umbelliferae families. It is obtained from any of these oils by distillation at  $200^{\circ} C.$  ( $392^{\circ} F.$ ); the more fluid distillate (hydrocarbons) is saved for various purposes, and the residue is subjected to freezing, whereby thymol crystallizes out; or may agitate this residue with sodium hydroxide solution, after a time add hot water to separate sodium-thymol ( $NaC_{10}H_{13}O$ ) solution from thymene and to allow the unattacked oil to float on top; to sodium hydroxide solution add hydrochloric acid, which sets thymol free; purify by distillation and crystallization; yield 20–61 p. c. It is in large, color-

FIG. 334.



*Thymus vulgaris*: A, plant in bloom; B, leaf seen from under surface, magnified 4 diam.; C, flower seen from the side, magnified 5 diam.

less, transparent rhombic prisms, aromatic, thyme-like odor, pungent, aromatic taste, with slight caustic effect upon the lips, sp. gr. when solid 1.030, liquefied by fusion lighter than water, melts at  $50^{\circ} C.$  ( $122^{\circ} F.$ ), liquefies when triturated with equal quantity of either camphor, menthol, hydrated chloral, phenol (carbolic acid), soluble in alcohol, ether, chloroform, 1,100 parts water, glacial acetic acid, fixed and volatile oils. *Tests*: 1. Heat 1 Gm., with 5 Cc. of 10 p. c. solution sodium hydroxide gives clear, colorless, or slightly reddish solution, darkening on standing but without separation of oily drops (abs. of thymene, levogyrate pinene); to this solution add few drops chloroform, shake, get violet color. 2. When heated in open dish should gradually volatilize without residue (abs. of inorganic substances,

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paraffin, spermaceti, etc.). Thymol is isomeric with carvacrol and carvol, in oil of caraway, and should be kept in well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.).

**PREPARATIONS.**—1. *Liquor Antisepticus*. Antiseptic Solution. (Syn., *Liquor Thymoli Compositus*, Listerine; Fr. *Liqueur Antiseptique*; Ger. *Antiseptische Lösung*.)

*Manufacture*: Dissolve boric acid 20 Gm. in water 700 Cc., also benzoic acid 1 Gm. in alcohol 150 Cc., and to this add boric acid solution; dissolve thymol 1 Gm. in eucalyptol 0.25 Cc. + oil of thyme 0.1 Cc., incorporate purified talc 20 Gm., and add previous solution with trituration, let stand with occasional agitation, filter, add alcohol 100 Cc., water q. s. 1,000 Cc. Dose, ʒss–2 (2–8 Cc.).

Antiseptic; a good substitute for the proprietary listerine and other aseptic preparations.

2. *Cataplasma Kaolini*,  $\frac{1}{2}$  p. c.

*Unoff. Preps.*: I. OIL: *Pills*. *Capsules*. II. THYMOL: *Solution*, for antiseptic spray (1 to 1,000). *Ointment*, 1–5 p. c. *Inhalation*, 1 gr. (.06 Gm.) to each. *Antiseptic Fluid*, 1 p. c. III. PLANT: *Fluidextract*, dose, ℥xv–60 (1–4 Cc.).

**PROPERTIES.**—I. OIL: Stimulant, tonic, emmenagogue, antispasmodic. If excessive doses given, have vomiting, depression, coldness, death by exhaustion, increased urine, which acquires green color and violet odor. II. THYMOL: Stimulant, antiseptic, deodorant, disinfectant, parasiticide, antipyretic, local anæsthetic. Its action stands between phenol (carbolic acid) and oil of turpentine, being 10 times less poisonous than the former, yet a far more powerful and permanent antiseptic; it is anæsthetic to the skin and mucous membranes, paralyzing the ends of sensory nerves; is eliminated by breath and urine.

**USES.**—I. OIL: Chlorosis, rheumatism, neuralgia, bronchitis, diarrhoea, gleet, gonorrhoea, leucorrhoea, vesical catarrh; externally in baths, lotions for scabies, muscular rheumatism, to correct fetor from sores, ulcers, gangrene. Applied to cotton for toothache, earache, for veterinary practice, scenting soap. II. THYMOL: Precisely like the oil, not much internally, but externally as an antiseptic in surgery, to lessen fetor from sores, ulcers, gangrene, in stomatitis, diphtheria, fetid bronchitis, coryza, rhinitis, ozæna, conjunctivitis, otorrhoea, gonorrhoea, uterine lochia, cancer, leucorrhoea, warts, skin diseases (psoriasis, eczema, etc.), diarrhoea, dysentery, typhoid fever, diabetes. A good dressing is thymol 1 Gm., alcohol 10 Cc., glycerin 30, water q. s. 1,000 Cc. Flies are fond of and often are attracted by it, which is its only objection.

*Thymacetin*,  $C_6H_5CH_2OC_2H_5C_3H_7NH.COCH_3$ , a derivative, has the same relation to thymol that phenacetin has to phenol (carbolic acid), and is prepared similarly; it is a white crystalline powder, soluble in alcohol, slightly in water. Analgesic, hypnotic; used in neuralgic headache like phenacetin. Dose, gr. 5–15 (.3–1 Gm.).

Thyme plant (fresh) is used as a condiment to aid digestion of fat pork, goose, duck, etc., and to flavor insipid dishes, as is sage, marjoram, parsley; it is used also with other aromatic herbs in baths, cataplasms, fomentations, for rheumatism, gout, scabies, indolent ulcers.



## MENTHA VIRIDIS. SPEARMINT.

*Mentha spicata*, Linné. } The dried leaves and flowering tops.  
*(Mentha viridis, Linné.)* }

*Habitat.* England, wild in Europe, N. America; cultivated in United States.

*Syn.* Mint, Mackerel, Lady's, Brown, Lamb or Common Garden Mint, Lamint, Sage of Bethlehem, Herba Menthae Romanæ or Acutæ; Fr. Menthe (romaine) vert, Baume vert; Ger. Grüne Münze, Römische Minze.

*Men'tha.* L. fr. Gr. *μνθη*, Minthe, a nymph, daughter of Cocytus, fabled to have been changed into a mint plant by Proserpine in a fit of jealousy (Theophrastus).

*Spi-cæ'ta.* L. spiked—i. e., the flowers.

*Vir'i-dis.* L. green—i. e., the stem.

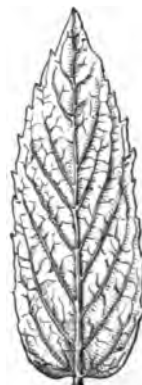
*Spear'mint* = *spear* + *mint*, from its spiry, spear-like inflorescence.

**PLANT.**—Perennial herb; rootstocks with elongated suckers, by which it multiplies extensively; stems .6–1.3 M. (2–4°) high, acutely quadrangular, branches opposite, smooth, often tinged with purple; flowers Aug.–Sept., calyx tubular, 5-toothed; corolla 4-lobed, light

FIG. 335.

*Mentha spicata (viridis)*: flowering tops.

FIG. 336.

*Mentha spicata (viridis)*: leaf, natural size.

spikes. **LEAVES**, 3–8 Cm. ( $1\frac{1}{2}$ –3') long, usually sessile and lanceolate, serrate, glandular, nearly smooth; branches square, mostly light green; flower-spikes usually slender, interrupted, cylindrical, or crowded, conical at apex, 5–8 Mm. ( $\frac{1}{5}$ – $\frac{1}{3}$ ') thick, becoming when in fruit 5–10 Cm. (2–4') long; odor and taste resembling, but distinguishable from, those of peppermint—heavier, less pleasant. Should be collected for medicinal use in dry weather just as the flowers appear; if for oil, col-

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lect just after flowers have expanded. This is weaker than peppermint, and probably is the cultivated form of *M. longifo'lia* (*sylves'tris*), *Horse-mint*. Loses on drying 75–85 p. c. *Solvents*: alcohol; water partially. Dose, gr. 30–60 (2–4 Gm.).

ADULTERATIONS.—Leaves of peppermint and other *Mentha* species.

CONSTITUENTS.—Volatile oil 0.5 p. c., resin, gum, tannin.

**Oleum Menthæ Viridis.** Oil of Spearmint, *official*.—(Syn., Fr. Essence de Menthe verte; Ger. Krauseminzöl, Römisch Minzöl.) This volatile oil, distilled from fresh or partly dried leaves and flowering tops of spearmint, and rectified by steam distillation, is a colorless or greenish-yellow liquid, darker and thicker by age, characteristic, strong odor of spearmint, hot, aromatic taste, sp. gr. 0.930, soluble (clear) with equal volume 80 p. c. alcohol, but turbid upon dilution, levogyrate; contains equal portions of *l*-limonene,  $C_{10}H_{16}$ , and *l*-carvone,  $C_{10}H_{14}O$ , possibly *l*-pinene and an unidentified alcohol,  $C_{10}H_{17}OH$ . *Assay*: For carvone (see oil of caraway, page 449). It is preserved for a long time by adding 3–4 p. c. alcohol. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ℥j–5 (.06–.3 Cc.).

PREPARATIONS.—I. LEAVES AND TOPS: 1. *Spiritus Menthæ Viridis*. Spirit of Spearmint. (Syn., Tinctura Olei Menthæ Viridis, Essence of Spearmint; Ger. Grüne Minzessenz.)

*Manufacture*: Macerate spearmint 1 Gm. + oil of spearmint 10 Cc. in alcohol q. s. 100 Cc. Dose, ℥x–30 (.6–2 Cc.).

II. OIL: 1. *Aqua Menthæ Viridis*. Spearmint Water. (Syn., Fr. Eau de Menthe verte; Ger. Römisch Minzwasser.)

*Manufacture*:  $\frac{1}{2}$  p. c. Triturate oil .2 Cc. with purified talc 1.5 Gm., distilled water q. s. 100 Cc., filter until clear. Dose, ʒss–1 (15–30 Cc.).

2. *Spiritus Menthæ Viridis*. Spirit of Spearmint, 10 p. c. Dose, ℥x–30 (.6–2 Cc.). See above.

*Unoff. Preps.*: I. LEAVES AND TOPS: *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.). *Fluidextract*, dose, ʒj–2 (4–8 Cc.). II. LEAVES AND TOPS, OR OIL: *Syrup*, dose, ʒj–4 (4–15 Cc.).

PROPERTIES.—Carminative, stimulant, nervine; flavoring.

USES.—Same as peppermint, but as it is much milder it is to be preferred in disorders of infancy, culinary purposes, confectionery, perfumery.

*Allied Plants*:

1. *Mentha cris'pa*, *Crisped-leaved*, *Cross* or *Curled Mint*.—This is the cultivated form of *M. spicata* (*viridis*), known also as *M. aquat'ica* var. *crispa*. Leaves pubescent, cordate pointed, crisped.

2. *M. sati'va*, *M. arven'sis*, and *M. rotundifo'lia*.—All under cultivation sometimes produce similar crisped leaves.

3. *Ly'copus virgin'icus*, *Bugle Weed*.—The herb, official 1830–1880. N. America. Plant has smooth, obtusely quadrangular stem, 15–60 Cm. (6–24') high; leaves 5 Cm. (2') long, elliptic, glandular; flowers purple, 4-lobed, stamens 2, mint odor and bitter taste, root perennial, creeping; contains volatile oil, resin, bitter principle, tannin. Used as astringent, tonic, sedative, narcotic, for hemorrhage, diarrhœa, dysentery; in infusion, decoction. Dose, gr. 5–30 (.3–2 Gm.).



<i>Apocynaceae</i> : 1. <i>Apocynum</i> . 2. <i>Apocynum</i> .	<i>Apocynum cannabinum</i> .	The dried rhizome.	N. America.	Apocynin, apocynin, tannin, resin, bitter extractive.	Fluidextract.	Emetic, cathartic, alterative, diuretic. Heart sedative, diuretic.	Dropsy, dyspepsia, intermittents.	2-30 (13-2 Gm.).
1. <i>Strophanthus</i> . 2. <i>Strophanthus</i> .	<i>Strophanthus Kombe</i> .	The ripe seed.	Africa, Asia.	Resin (jalapin and jalapurgin), starch, kumbe acid.	Tincture.	Hydroagogue, cathartic, diuretic.	Bright's disease, heart palpitation, endocarditis, asthma, dropsy.	1 1/2-1/4 (66-108 Gm.).
<i>Onocleaceae</i> : 2. <i>Jalapa</i> .	<i>Exogonium purga</i> .	The dried tuberous root.	East Mexico.	Resin (jalapin and jalapurgin), starch, gum.	Comp. powder, resin, comp. cath. pills, veg. Resin, extr. colocynd. comp.	Hydroagogue, cathartic, diuretic.	Constipation, dropsy, fever, inflammation, tions, head affections.	5-20 (3-13 Gm.).
1. <i>Scammonium</i> . 2. <i>Scammonium</i> .	<i>Convolvulus Scammonia</i> .	The gum-resin.	W. Asia.	Resin, gum.	Fluidextract.	Expectorant, bitter tonic, stimulant.	Dropsies, cerebral affections, torpid intestines.	1-5-10 (66-37-6 Gm.).
<i>Hydrophyllaceae</i> : 1. <i>Erodietyon</i> . 2. <i>Erodietyon</i> .	<i>Erodietyon californicum</i> .	The dried leaves.	California.	Volatile oil, resin, erodietyonic acid.	Fluidextract.	Expectorant, bitter tonic, stimulant.	Bronchitis, asthma, to disguise quiniae taste.	30-60 (2-4 Gm.).
<i>Labiatae</i> : 1. <i>Scutellaria</i> . 2. <i>Scutellaria</i> .	<i>Scutellaria lateriflora</i> .	The dried plant.	N. America.	Volatile oil, tannin, bitter principle, sugar.	Fluidextract.	Tonic, nervine, antispasmodic.	Hysteria, epilepsy, nervousness, chorea, neuralgia, intermittents.	30-60 (2-4 Gm.).
1. <i>Marrubium</i> . 2. <i>Marrubium</i> .	<i>Marrubium vulgare</i> .	The dried leaves and tops.	Europe, C. Asia.	Volatile oil, marrublin, tannin, resin.	.....	Stimulant, tonic, deobstruent, antispasmodic.	Dyspepsia, bronchitis, indigestion, amenorrhoea, phthisis, rheumatism.	30-60 (2-4 Gm.).
1. <i>Salvia</i> . 2. <i>Salvia</i> .	<i>Salvia officinalis</i> .	The dried leaves.	S. Europe.	Volatile oil, resin, tannin, extractive.	.....	Stimulant, tonic, strygent, vulnerary.	Dyspepsia, sweats, ulcers of mouth, sores, nasal catarrh, sore throat.	15-10 (1-4 Gm.).
1. <i>Hedeoma</i> . 2. <i>Hedeoma</i> .	<i>Hedeoma pulegioides</i> .	The dried leaves and tops.	N. America.	Volatile oil, tannin, bitter principle.	Oil.	Stimulant, carminative, emmenagogue.	Colic, nausea, indigestion, diarrhoea, rheumatism, amenorrhoea.	15-60 (1-4 Gm.).
1. <i>Oleum Thym.</i> . 2. <i>Oil of Thyme</i> .	<i>Thymus vulgaris</i> .	The volatile oil.	S. Europe.	Cymene, thymene, thymol.	Thymol, antisept. sol.	Stimulant, tonic, emmenagogue, antispasmodic, antiseptic.	Chlorosis, rheumatism, neuralgia, bronchitis, diarrhoea, sleep, vesical catarrh.	Minims. 1-5 (66-3 (c.).
1. <i>Mentha Viridis</i> . 2. <i>Spearmint</i> .	<i>Mentha spicata (viridis)</i> .	The dried leaves and tops.	Europe, N. America.	Volatile oil, resin, tannin, gum.	Spirit. <i>Oil</i> : water, spirit.	Carminative, stimulant, nervine.	Cholera infantum, cutaneous and confectionery purposes, perfume.	Grains. 30-60 (2-4 Gm.).

## MENTHA PIPERITA. PEPPERMINT.

**Mentha**  
**piperita**, Linné. } The leaves and flowering tops.

*Habitat.* Asia, Europe, N. America; wild in low grounds, wet places; cultivated in gardens, etc.

*Syn.* Brandy or Lamb Mint, Lammin, Herba Menthe Piperitæ; Fr. Menthe poivrée; Ger. Folia Menthe piperitæ, Pfefferminz-blätter.

**Pi-pe-ri'ta.** L. *piper*, pepper—peppery-mint—i. e., from its aromatic burning taste.

*Pep'permint* = pepper + mint—i. e., mint with pepper properties.

**PLANT.**—Perennial herb, possibly from *M. hirsuta*, *Water Mint*, by cultivation; rootstock creeping, producing long suckers by which it multiplies; stem square, purplish, .6–1.3 M. (2–4°) high. **LEAVES**, 3–8 Cm. (1½–3') long, petiolate, ovate-lanceolate, acute, sharply serrate, light or dark green, glandular, nearly smooth, the few hairs containing menthol crystals in one or more thin cells, branches quadrangular, often purplish, with scattered deflexed hairs; flower-whorls in oblong or oval spikes, which are usually compact or somewhat interrupted at base, 1–1.5 Cm. (½–¾') broad, rounded at summit, when in fruit becoming 3–7 Cm. (1½–3') long, calyx tubular, 5-toothed, often purplish, corolla small, purplish, 4-lobed, stamens 4, short and equal; odor strong, characteristic; taste pungent, cooling; powder

contains subglobular, shortly and stoutly stalked oil-glands, hairs possessing cells with menthol crystals. Should be collected for medicine in dry weather, Aug.–Sept., while blooming, and is the strongest and most pungent of all the mints. *Solvents*: alcohol; water partially. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—1. Leaves chiefly of varieties of this species: (a) var. *officinalis*; leaves narrower, spikes longer; (b) var. *rulga'ris*; leaves broader, base more rounded, spikes more blunt and close. 2. Spearmint leaves; these can be distinguished readily, as peppermint has leaves with petioles, inflorescence thicker, more crowded, flowers larger with shorter calyx-teeth, and its own distinctive odor and taste.

**CONSTITUENTS.**—Volatile oil 1 p. c. (menthol), resin, tannin, gum.

**Oleum Menthe Piperitæ.** Oil of Peppermint, *official*.—(Syn., Fr. Essence de Menthe poivrée; Ger. Pfefferminzöl.) This volatile oil, distilled from fresh or partly dried leaves and flowering tops of peppermint with water or steam, and rectified by steam distillation, is a colorless liquid, darker and thicker by age, characteristic strong odor of peppermint, strongly aromatic, pungent

FIG. 337.



Mentha piperita: flowering tops.

**LABIATE.**

taste, followed by sensation of cold upon drawing air into the mouth, sp. gr. 0.910, soluble (clear) in equal volume alcohol, in 4 volumes 70 p. c. alcohol, levogyrate; contains 16 constituents: acetic and isovaleric (valerianic) acids, acetaldehyde, isovaleric aldehyde, amyl alcohol, pinene, phellandrene, limonene, cineol, menthone, menthyl isovalerate, menthyl ester, cadinene, a lactone, dimethyl sulphide, and two others of most importance—at least 8 p. c. of ester, calculated as menthyl acetate, and at least 50 p. c. of total menthol (free and as ester), Japanese oil 50–80 p. c.; distilled with  $P_2O_5$  yields menthene,  $C_{10}H_{18}$ , a colorless liquid of pleasant odor. The hydrocarbons holding menthol dissolved are mainly several terpenes with carvene odor, the higher boiling ones,  $C_{15}H_{24}$ , having less pleasant odor. The oil is preserved a long time by adding 3–4 p. c. alcohol. *Tests*: 1. From oil 25 Cc. distil 1 Cc., pour this on an aqueous solution mercuric chloride—a white film should not form at the zone of contact (abs. of dimethyl sulphide, found in non-rectified

FIG. 338.



*Mentha piperita*: flower and corolla cut open; magnified 8 diam.

oils). 2. Oil in a test-tube immersed into salt and ice should within 15 minutes become cloudy and thick, and with a menthol crystal added should form crystalline mass (dis. from dementholized oil). *Assay*: Weigh 10 Cc. oil, add 25 Cc.  $\frac{N}{2}$  alcoholic potassium hydroxide V. S., connect with reflux condenser, boil 1 hour, cool, titrate alkali with  $\frac{N}{10}$  sulphuric acid V. S., using phenolphthalein T. S. indicator; the difference in Cc. between the two V. S. multiplied by 9.834, the product divided by weight of oil, = p. c. of menthyl acetate. Wash residual oil repeatedly with water, transfer to acetylation flask, add 10 Cc. acetic acid aldehyde + 1 Gm. anhydrous sodium acetate, boil 1 hour, cool, wash acetylated oil with distilled water, then with sodium hydroxide T. S., until mixture alkaline to phenolphthalein T. S., dry with aid of fused calcium chloride, filter. Transfer 5 Cc. to tared 100 Cc. flask, note weight, add 50 Cc.  $\frac{N}{10}$  alcoholic potassium hydroxide V. S., connect with reflux condenser, boil 1 hour, cool, titrate residual alkali with sulphuric acid V. S., using phenolphthalein T. S. indicator; the difference in Cc. between the two V. S. multiplied by 7.749, the product divided by weight of dry acetylated oil taken, less the above difference

multiplied by 0.021; the quotient = p. c. of menthol in the oil. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{Mj}$ -5 (.06-.3 Cc.).

**ADULTERATIONS.**—Oil of erigeron, castor oil, oil of turpentine, oil of copaiba, oil of camphor, oil of sassafras, alcohol; the first, second, and third prevent its solubility in equal volume alcohol (80 p. c.); the fourth gives buttery mass with sulphuric acid; oils of turpentine, camphor, and sassafras each render its action with iodine more violent, the two latter being red with nitric acid.

**Menthol.**  $\text{C}_{10}\text{H}_{18}\text{OH}$ , *official*.—(Syn., Pipmenthol, Peppermint Camphor; Fr. Camphre de Menthe; Ger. Mentholum, Pfefferminzkamfer, Mentha-kamfer.) This is a secondary alcohol (stearopten), obtained from official oil of peppermint (*M. piperita*), or from Japanese or Chinese oil of peppermint (*M. arven'sis* var. *piperas'cens* and *M. canadensis* var. *glabra'ta*). To obtain this the volatile oil is subjected simply to refrigeration at  $-22.2^{\circ}\text{C}$ . ( $-8^{\circ}\text{F}$ .) by means of ice and salt; when solidified, the temperature is allowed to rise gradually, the resulting liquid occasionally poured off, and crystals deprived of oil by expression; may be purified by recrystallization. It is in colorless, acicular, or prismatic crystals, with strong and pure odor of peppermint, warm, aromatic, finally cooling taste, soluble in alcohol, ether, chloroform, glacial acetic acid, slightly in water; melts at  $43^{\circ}\text{C}$ . ( $109.4^{\circ}\text{F}$ .) to a colorless liquid, which boils at  $212^{\circ}\text{C}$ . ( $414^{\circ}\text{F}$ .); is slightly volatile at ordinary temperature. When triturated with equal weight of camphor, thymol, or hydrated chloral the mixture becomes liquid; with potassium dichromate and sulphuric acid (chromic acid) oxidizes into ketone, menthone,  $\text{C}_{10}\text{H}_{18}\text{O}$ ; combines with organic acids to form esters—menthyl acetate, benzoate, formate, valerate (valerianate); with dehydrating agents converted into hydrocarbons menthene and dimenthene. *Tests*: 1. When heated on water-bath should be completely volatile (abs. of wax, paraffin, or inorganic substances). 2. A few crystals dissolved in 1 Cc. glacial acetic acid + 3 drops sulphuric acid + 1 drop nitric acid should not give green color (abs. of thymol). Dose, gr. 1-2 (.06-.13 Gm.).

**ADULTERATIONS.**—Mostly wax, paraffin, magnesium sulphate, thymol.

**PREPARATIONS.**—I. LEAVES AND TOPS: 1. *Spiritus Menthae Piperitæ*. Spirit of Peppermint. (Syn., Essence of Peppermint; Fr. Alcoolat (Essence) de Menthe poivrée; Ger. (Englische) Pfefferminz (-essenz)-spiritus.)

*Manufacture*: Macerate peppermint 1 Gm. + oil of peppermint 10 Cc. in alcohol q. s. 100 Cc. Dose,  $\text{Mx}$ -30 (.6-2 Cc.).

*Prep.*: 1. *Mistura Rhei et Sodæ*, 3.5 p. c.

II. OIL: 1. *Aqua Menthae Piperitæ*. Peppermint Water. (Syn., Fr. Eau de Menthe poivrée; Ger. Pfefferminzwasser.)

*Manufacture*:  $\frac{1}{2}$  p. c. Triturate oil .2 Cc. with purified talc 1.5 Gm., distilled water q. s. 100 Cc., filter until clear. Dose,  $\text{3ss}$ -1 (15-30 Cc.).

## LABIATÆ.

2. *Spiritus Menthæ Piperitæ*. Spirit of Peppermint, 10 p. c. Dose,  $\text{m}_x$ -30 (.6-2 Cc.). See page 532.

3. *Cataplasma Kaolini*,  $\frac{1}{2}$  p. c. 4. *Liquor Antisepticus*,  $\frac{1}{2}$  p. c. 5. *Pilulæ Cathartice Vegetabiles*,  $\frac{1}{8}$   $\text{m}$  (.008 Cc.). 6. *Pilulæ Rhei Compositæ*,  $\frac{1}{8}$   $\text{m}$  (.005 Cc.) in each pill.

*Unoff. Preps.*: *Infusion*, 5 p. c., dose,  $\text{3j}$ -2 (30-60 Cc.). *Fluid-extract*, dose,  $\text{3j}$ -2 (4-8 Cc.). *Syrup*, dose,  $\text{3j}$ -4 (4-15 Cc.). *Troche* (each contains oil  $\frac{1}{4}$   $\text{m}$ ; .009 Cc.). *Emplastrum Menthol* (Br.), 15 p. c. + yellow wax 10, rosin 75.

**PROPERTIES.**—Carminative, stimulant, nervine, antispasmodic.

**USES.**—Spasmodic stomach and bowel pains, flatulency, nausea, cholera morbus, diarrhœa, dysentery, colic, dysmenorrhœa, nervous headache, hiccough, heart palpitation, vomiting, as a flavoring agent; externally the oil and menthol for rheumatism, neuralgia, toothache, antibacterial.

## LAVANDULA. LAVENDER.

**Oleum Lavandulæ Florum.** Oil of Lavender Flowers, *official*.

**Lavandula officinalis**, *Chair*. } A volatile oil, distilled from the fresh flowering tops.

*Habitat.* S. Europe (France, Italy, Spain), N. W. Africa, sunny hillsides and mountains; cultivated.

*Syn.* Garden, Common, or Spike Lavender, Flores Lavandulæ; Fr. Lavande officinale, Essence de Lavande; Ger. Lavendelblüthen, Lavendelöl.

**La-van'du-la.** L. fr. *lavo, lavare*, to wash—i. e., medieval name, in allusion to the use made of its distilled water for bathing.

**Of-fi-ci-na'lis.** L. see etymology of (*Asagrea*) *officinalis*, page 101.

**PLANT.**—Shrub .3-1 M. (1-3°) high; stem crooked, branched, bark brownish-gray, much cleft when old; leaves linear, sessile, entire, revolute margins, with whitish down, crowded at bases of the quadrangular branches; flowers June-July, lilac-colored, terminal spikes, 2-lipped, hairy, glandular. Whole plant delightfully fragrant.

**CONSTITUENTS.**—Volatile oil 1-3 p. c., resin, tannin.

**Oleum Lavandulæ Florum.** Oil of Lavender Flowers.—A yellowish liquid, fragrant odor of lavender flowers, pungent, bitter taste, sp. gr. 0.890, soluble in 3 volumes 70 p. c. alcohol; contains a terpene,  $\text{C}_{10}\text{H}_{16}$ , 2 alcohols—geraniol,  $\text{C}_{10}\text{H}_{18}\text{O}$ , and (chiefly) linalool,  $\text{C}_{10}\text{H}_{18}\text{O}$ , also its compound ether—linaloyl acetate,  $\text{C}_{10}\text{H}_{17}\text{C}_2\text{H}_3\text{O}_2$ , 30-36 p. c., upon which the value depends, and a little cineol; the presence of this latter in considerable quantity proves the adulteration with oil of spike lavender. When cold deposits stearopten, and if distilled from leaves and stalks the odor is more rank. *Tests*: 1. When shaken with water in a narrow graduated cylinder, its volume should not be diminished (abs. of alcohol). The *French* oil is from flowers, sometimes including leaves, of wild plants, July-Sept., the late and high altitude product being best; the *English* oil (oil of garden lavender) is solely from flowers of cultivated plants, the yield being small and price high.



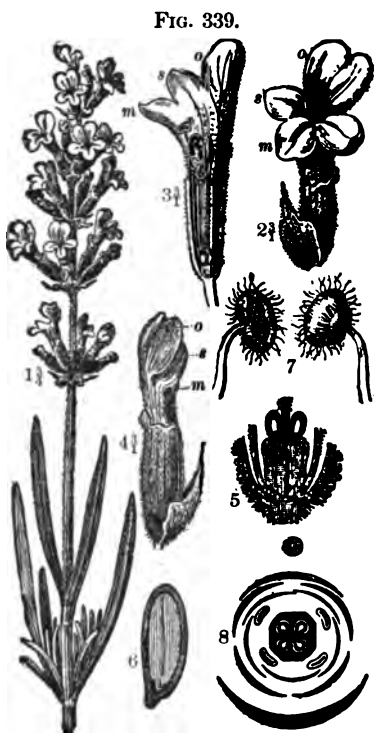
Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{mj}-5(.06-.3 \text{ Cc.})$ .

**ADULTERATIONS.**—Oil of turpentine (less soluble in alcohol), oil of spike lavender (greener, more terebinthinate, camphoraceous odor, with more terpene and cineol, oil of sweet basil (*O'cimum Basili'cum*). Asia, Africa. This plant is cultivated in gardens for seasoning food and for its white or reddish flowers; oil is balsamic, aromatic, possessing a cooling taste.

**PREPARATIONS.**—1. *Spiritus Lavandulæ*. Spirit of Lavender. (Syn., Fr. Alcoolat (Esprit, Eau) de Lavande; Ger. Lavendelspiritus.)

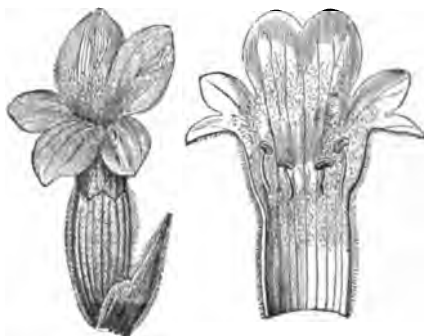
**Manufacture:** 5 p. c. Dissolve oil 5 Cc. in alcohol 95 Cc. Dose,  $\text{ss}-1 (2-4 \text{ Cc.})$ .

**Prep.:** 1. *Mistura Ferri Composita*, 6 p. c.



*Lavandula officinalis*: 1, flowering twig; 2, flower with sepal; 3, longitudinal section of flower; 4, flower bud; 5, vertical section of flower bud with ovary; 6, vertical section of little nut; 7, stamens; 8, diagram of flower.

FIG. 340.



Lavender flower and corolla: magnified 4 diam.

2. *Tinctura Lavandulæ Composita*. Compound Tincture of Lavender. (Syn., *Spiritus Lavandulæ Compositus*, Lavender Drops; Fr. Teinture de Lavande composée; Ger. Zusammengesetzte Lavandeltinktur.)

**Manufacture:**  $\frac{4}{5}$  p. c. Dissolve oil of lavender flowers .8 Cc. + oil of rosemary .2, in alcohol 75, add water 25; with this macerate 3 days saigon cinnamon 2 Gm., cloves .5, nutmeg 1, red saunders 1, finishing with alcohol 75 p. c., q. s. 100 Cc. Dose,  $\text{ss}-1 (2-4 \text{ Cc.})$ .

**Prep.:** 1. *Liquor Potassii Arsenitis*, 3 p. c. (arsenic trioxide 1 p. c., potassium bicarbonate 2 p. c.).

3. *Linimentum Saponis Mollis*, 2 p. c. 4. *Spiritus Ammoniac Aromaticus*,  $\frac{1}{10}$  p. c. 5. *Unguentum Diachylon*, 1 p. c.

**Unoff. Preps.:** Water (*Aqua*). Of flowers may have *Infusion* and *Fomentation*.

## LABIATE.

PROPERTIES.—Stimulant, carminative, nervine, errhine.

USES.—Gastralgia, nausea, flatulence, to correct nauseating medicines, nervous headache; mostly in perfumery.

Flowers, official 1840–1890. *Oleum Lavandulae*, official 1880–1890; distilled from the entire fresh flowering plant.

## Allied Plants:

1. *Lavandula spi'ca*, *Spike Lavender*, *Male Lavender*.—The flowers, official 1820–1840. S. France; cultivated. Plant .3–.5 M. (12–18') high, branching from base; leaves broad, oblanceolate, sessile, revolute at the edge, with whitish down; flowers July, villous, lilac-colored. *L. stœ'chas*, *Arabian* or *French Lavender*. Flowers dark purple; odor aromatic, camphoraceous. These with other varieties used for obtaining the oil.

2. *Collins'o'nia canad'en'sis*, *Stone-root*, *Horse-balm*.—N. America. Rhizome 10 Cm. (4') long, branches short, knotty, white inside, inodorous, taste bitter, nauseous; contains volatile oil, resin. Diaphoretic, diuretic, tonic, astringent, irritant.

## ROSMARINUS. ROSEMARY.

*Oleum Rosmarini*. Oil of Rosemary, official.

**Rosmarinus officinalis**, Linné. } A volatile oil, distilled from the fresh flowering tops.

*Habitat*. Mediterranean Basin (Spain to Asia Minor, N. Africa, reaching to Madeira and the Canary Islands); cultivated in gardens.

*Syn*. Garden Rosemary, *Folia Rosmarini*—*Roris Marini*—*Anthos*, *Oleum Anthos*; Fr. *Romarin*, *Huile volatile* (*Essence*) de *Romarin*; Ger. *Rosmarin*, *Rosmarinöl*.

**Ros-ma-ri'nus**. L. *ros*, dew, mist, + *marinus*, *maris*, of the sea—sea foam—i. e., from its maritime habitat and glaucous appearance. *Rosemary*—not Mary's rose.

**Of-fi-ci-na'lis**. L. see etymology of (*Asagraea*) *officinalis*, page 101.

PLANT.—Small perennial shrub 1–1.3 M. (3–4°) high, bushy, much branched; bark pale brown, twigs tomentose; flowers April–May, bilabiate, upper lip 2-parted, lower 3-divided, middle one being the largest, pale blue; fruit achenes, subglobose, smooth; leaves evergreen, many, sessile, 2.5 Cm. (1') long, linear, both ends blunt, entire, margins revolute, dark green, shining above, woolly with white, stellate hairs beneath, like the flowers, with aromatic fragrance, camphor-like; taste bitter.

CONSTITUENTS.—Volatile oil 1 p. c., resin, tannin, bitter principle.

*Oleum Rosmarini*. Oil of Rosemary.—A pale yellow, limpid liquid, characteristic pungent odor of rosemary, warm camphoraceous taste, sp. gr. 0.900, soluble in  $\frac{1}{2}$  volume or more 90 p. c. alcohol, 2 volumes 80 p. c. alcohol, dextrogyrate; contains pinene,  $C_{10}H_{16}$ , 80 p. c., camphene, cineol,  $C_{10}H_{18}O$ , camphor,  $C_{10}H_{18}$ , also at least 5 p. c. of ester, calculated as bornyl acetate, and not less than 15 p. c. total borneol,  $C_{10}H_{17}OH$ . *Assay*: Weigh 10 Cc. oil in tared flask, add 25 Cc.  $\frac{N}{2}$  alcoholic potassium hydroxide V. S., connect with reflux condenser, boil 1 hour, cool, titrate alkali with  $\frac{N}{10}$  sulphuric acid V. S., using phenolphthalein T. S. indicator; multiply

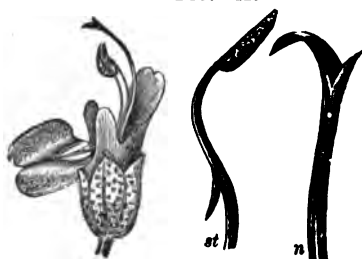
difference in Cc. of two V. S. by 9.734, divide product by weight of oil, = p. c. bornyl acetate. Wash residual oil with water, transfer it to an acetylation flask, add 10 Cc. acetic acid anhydride + 1 Gm. anhydrous sodium acetate, boil 1 hour, cool, wash acetylated oil with distilled water, then with sodium hydroxide T. S., until mixture slightly alkaline to phenolphthalein T. S., dry with aid of fused calcium chloride, filter. Transfer to tared 100 Cc. flask 5 Cc. dry acetylated oil, note

FIG. 341.



*Rosmarinus officinalis*: branch and flowers.

FIG. 342.



*Rosmarinus officinalis*: st, stamen with anther; n, style with stigma.

weight, add 50 Cc.  $\frac{N}{10}$  alcoholic potassium hydroxide V. S., connect with reflux condenser, boil 1 hour, cool, titrate residual alkali with  $\frac{N}{2}$  sulphuric acid V. S., using phenolphthalein T. S. indicator; multiply difference in Cc. of two V. S. by 7.649, divide product by weight of dry acetylated oil taken, less the above difference multiplied by 0.021; quotient = p. c. borneol in oil. The Italian or Dalmatian oil (distilled after flowering season), and the finer odored French oil (distilled from the flowering tops) are the chief commercial varieties, although the English (from cultivated plants) and Spanish are high priced and greatly esteemed by some. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{Mj}$ –5 (.06–.3 Cc.).

**ADULTERATIONS.**—OIL: Oil of turpentine, etc.—recognized by equal volume of alcohol dissolving out rosemary oil, leaving behind oil of turpentine.

**PREPARATIONS.**—1. *Linimentum Saponis*, 1 p. c. 2. *Tinctura Lavandulae Composita*,  $\frac{1}{2}$  p. c.

*Unoff. Prep.*: *Spiritus Rosmarini* (Br.), oil 10 p. c.

**PROPERTIES.**—Carminative, stimulant, diuretic, diaphoretic, emmenagogue. Excessive doses cause death.

**USES.**—Colic, nervous disorders, menstrual derangements. Externally in rheumatism, sprains, bruises. Stimulates the hair in alopecia, reduces temperature, and imparts violet odor to urine. Mainly used in liniments, lotions, ointments, perfumery.

Tops or Leaves, official 1820–1890.

## 72. SOLANACEÆ. Nightshade (Potato) Family.

Sol-a-na'se-e. L. *Solan-um* + acœ, fr. *sol*, the sun—i. e., its plants dislike sunlight, grow best in the shade, hence nightshade; or *solor*, to comfort—i. e., the plants, soothing, narcotic effect; or *sulanum*, *sus*, hog

**SOLANACEÆ.**

—*i. e.*, plants act as cure for swine disease. Herbs, rarely shrubs, trees. Distinguished by having colorless juice, mydriatic alkaloids, alternate leaves; flowers regular, 5's, isomerous, plicate border; ovary superior, 2-celled, ovules many, embryo straight or coiled in fleshy albumin; fruit, capsule or berry, some edible. Differs from Convolvulaceæ by not twining and in having many seeds; universal, tropics; narcotic, stimulant, bitter, tonic, poisonous.

Genera: 1. *Capsicum*. 2. *Atropa*. 3. *Scopola*. 4. *Hyoscyamus*. 5. *Datura*.

**CAPSICUM. CAPSICUM.**

**Capsicum fastigiatum**, *Blume*. } The dried, ripe fruit, deprived of its calyx.

*Habitat.* S. and C. America (Cayenne in Guiana), introduced into E. Indies, Java (by Portuguese), also into Africa; cultivated in United States, also in tropics.

*Syn.* Cayenne or African Pepper, Spanish, Red, Bird, Garden, Cockspur, Pod, Chilly, Zanzibar, Goat's, Guinea, American Cayenne or African Cayenne Pepper, Chillies; *Piper Hispanicum*; *Br. Capsici Fructus*; *Fr. Capsique*, *Piment (rouge) des jardins*, *Poivre de Cayenne*, *Guinée or d'Inde*; *Ger. Fructus Capsici*, *Spanischer Pfeffer*, *Schlottenpfeffer*.

**Cap'si-cum.** *L. capsæ*, a box—*i. e.*, shape of the fruit; or from *κάπτω*, to bite—*i. e.*, from its hot, pungent properties.

**Fas-tig-i-a'tum.** *L. fastigiatum*, pointed, tapering—*i. e.*, shape of the fruit.

**PLANT.**—Herb .6–1 M. (2–3°) high; stems spreading; leaves 5–7.5 Cm. (2–3') long, flowers July–Aug., 2–3 together in the bifurcations,

FIG. 343.

*Capsicum fastigiatum.*

yellow. **FRUIT**, oblong-conical, 10–20 Mm. ( $\frac{2}{5}$ – $\frac{4}{5}$ ') long, 5 Mm. ( $\frac{1}{5}$ ') thick, with a red, shining, membranous and translucent pericarp; 2-celled, containing 10–20 flat, reniform, yellowish seeds attached to a thick, central placenta; odor distinct; taste intensely pungent; powder dark orange-red, fading upon age, containing few or no starch grains or sclerenchymatous fibres. Mostly imported from India and Africa—

Liberia, Zanzibar, Natal, Bombay, Penang, Pegu, Cayenne, although we grow much of our supply. The fruit is plucked, exposed to sun until dried, and then packed in suitable shape for market. *Solvents*: alcohol; ether; hot water partially. Dose, gr. 1–5 (.06–.3 Gm.).

**ADULTERATIONS.**—**FRUIT**: Fruits of allied species; **POWDER**: Red lead oxide, colored sawdust, bran, etc., the former recognized by adding diluted nitric acid to dissolve lead and precipitating same with sodium sulphate; the two latter detected by the microscope.

**CONSTITUENTS.**—Capsaicin (capsacutin, capsin) 0.02 p. c., Capsicine, Volatile oil, fixed oil, fat acids (oleic, stearic, palmitic), resin, red coloring matter (cholesterin ester of the fatty acids), ash 4–5 p. c.

**Capsaicin**,  $C_{18}H_{28}NO_3$ .—Thought to be identical with capsacutin, resides mostly in the pericarp and placenta; it is the chief, active constituent, and is obtained by adding diluted caustic alkali to the petroleum extract, passing  $CO_2$  through this alkaline solution, when it crystallizes out in colorless form. It is soluble in alcohol, ether, benzene, fixed oils, and its vapors are intensely acrid and irritating. It has also been obtained as an oleoresin (capsicin), amorphous resin-like acid, to which the red coloring matter persistently adheres. Dose, gr.  $\frac{1}{10}$ – $\frac{1}{4}$  (.006–.016 Gm.).

**Capsicine.**—This occurs in small quantity; it is a volatile alkaloid, having odor of conine—devoid of pungency—and is an oily liquid,

FIG. 344.

Capsicum fruit:  
magnified.

FIG. 345.

Capsicum fruit: cross-  
section, magnified.

FIG. 346.

Capsicum annuum: fresh fruit  
one-half natural size.

not existing in the unripe fruit, but results from decomposition processes in ripening

**Volatile Oil.**—Obtained by distillation and gives to the fruit its odor.

**PREPARATIONS.**—1. *Fluidextractum Capsici*.

Fluidextract of Capsicum. (Syn., Extractum Capsici Fluidum, U. S. P. 1890; Fr. Extrait

liquide (de Capsique) de Piment des jardins; Ger. Flüssiges Spanisch-Pfefferextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol q. s., evaporate to 100 Cc. Dose,  $\mathfrak{m}\text{j}$ –5 (.06–.3 Cc.).

2. *Oleoresina Capsici*. Oleoresin of Capsicum. (Syn., Fr. Oléo-résine (Extrait étherée) de Capsique; Ger. Spanisch-Pfefferölharz.)

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*Manufacture:* Percolate 100 Gm. with acetone until 160 Cc. percolate obtained, recover acetone by distillation on water-bath, pour off liquid portion, transfer remainder to funnel with pledget of cotton, when separated fatty matter (which is to be rejected) has drained, mix

FIG. 347.

*Solanum Dulcamara.*

liquid portion; yield 12–15 p. c. Should be kept in well-stoppered bottles. Dose,  $m\frac{1}{4}$ –1 (.016–.06 Cc.).

Prep.: 1. *Emplastrum Capsici*. Capsicum Plaster. (Syn., Fr. *Sparadra(pum) Capsici* (de Capsique); Ger. *Capsicumplaster*.)

*Manufacture:* Apply oleoresin of capsicum 0.25 Gm. to surface of

adhesive plaster with a brush, forming thin coat over 15 Cm. (6') square, leaving a margin; requires about 6℥ (.4 Cc.).

3. *Tinctura Capsici*. Tincture of Capsicum. (Syn., Fr. Teinture de Piment des jardins; Ger. Spanischpfeffertinktur.)

*Manufacture*: 10 p. c. Percolate 10 Gm. with alcohol 95 p. c., q. s. 100 Cc. Dose, ℥x-60 (.6-4 Cc.).

4. *Pilulæ Podophylli, Belladonnæ et Capsici*,  $\frac{1}{2}$  gr. (.03 Gm.).

*Unoff. Preps.*: *Unguentum Capsici* (Br.), 20 p. c. *Extract*, dose, gr.  $\frac{1}{2}$ -2 (.03-.13 Gm.). *Infusion*, 5 p. c., dose, 3ij-4 (8-15 Cc.).

**PROPERTIES.**—Stimulant, stomachic, rubefacient, condiment, diaphoretic; stimulates flow from salivary, gastric, and intestinal glands, also the stomach walls and heart.

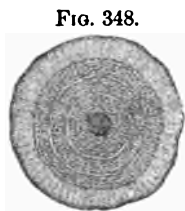
**USES.**—Indigestion, dyspepsia, atonic gout, alcoholism, delirium tremens, intermittents; flatulent colic, low fevers, cholera, menorrhagia, seasickness, tonsillitis, scarlet fever, diphtheria, hemorrhoids; externally—lumbago, rheumatism, neuralgia, chilblains, relaxed uvula. Was known to the Romans, and used in E. Indies from time immemorial.

*Allied Plants*:

1. *Capsicum an'nuum* (lon'gum).—Fruit, official 1820-1880. Fruit 5-10 Cm. (2-4') long, 2.5-4 Cm. (1-1 $\frac{3}{8}$ ') thick, oblong, conical, sometimes curved or subglobular, yellow or red, brown when dry. Known in England as pod pepper, but often sold as *chillies* or *capsicums*, and is the kind recognized by the Ger. Phar.

2. *C. frutescens*.—Fruit like official, 8-12 Mm. ( $\frac{1}{3}$ - $\frac{1}{2}$ ') long, 3-4 Mm. ( $\frac{1}{8}$ - $\frac{1}{4}$ ') thick. *C. cerasi'forme*, fruit resembles a cherry. All three sometimes used for purposes similar to official.

3. *Solu'num Dulcamara', Dulecamara, Bittersweet*.—The dried young branches, official 1820-1900; Europe, Asia (N. America). Climbing, pubescent shrub, around dwellings, in thickets; stem woody at base, branching, 3-4.5 M. (10-15°) high; leaves cordate, halberd-shaped, pubescent beneath; flowers purple, whitish; fruit oval red berry, many-seeded. Branches, collected when 1-2 years old, in autumn or early spring; occurs in short sections, 8 Mm. ( $\frac{1}{3}$ ') long, 5 Mm. ( $\frac{1}{5}$ ') thick, cylindrical, hollow, angular, striate, warty; bark thin, pale greenish-brown; wood greenish-yellow, in 1-2 concentric rings; odor slight, when fresh unpleasant; taste bitter, then sweet; contains dulcamarin 0.4 p. c., solanine, resin, gum, wax, benzoic acid, starch, calcium lactate. Narcotic, diuretic,



Dulcamara: transverse section of a branch, magnified 3 diam.

diaphoretic, alterative, deobstruent; large doses produce vomiting, faintness, vertigo, convulsive muscular movements, dryness and constriction of the throat, thirst, diarrhoea, weakened heart action, paralysis. Cutaneous eruptions, rheumatism, gout, bronchitis, whooping-cough, nasal, vesical, and pulmonary catarrhs, mania with strong venereal desire, neuralgia. *Poisoning*: Same as for belladonna. Dose, 3ss-1 (2-4 Gm.); fluidextract (diluted alcohol), 3ss-1 (2-4 Cc.).

4. *S. panicula'tum*.—S. America; tonic, diuretic, antiperiodic, vesi-

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cal catarrh. *S. carolinense*, *Horse-nettle*. United States; aphrodisiac, tincture for epilepsy. Dose, 3ss–1 (2–4 Cc.).

5. *Ly'cium vulga're*.—United States, Europe; *L. a'frum*, N. Africa, and *L. umbro'sum*, S. America. The leaves of these in infusion good for erysipelas and skin diseases.

**BELLADONNA. BELLADONNA.**

1. BELLADONNÆ FOLIA. Belladonna Leaves.

2. BELLADONNÆ RADIX. Belladonna Root.

**Atropa**

**Belladonna**, Linné.

- { 1. The dried leaves, containing 0.35 p. c. of mydriatic alkaloids. 2. The dried root, containing 0.5 p. c. of mydriatic alkaloids.

*Habitat.* C. and S. Europe, Asia Minor, Algeria, in waste ground, mountainous woods; cultivated in Germany, France, England, N. America.

*Syn.* Deadly or Sleeping Nightshade, Death's Herb, Banewort, Mekilwort, Black or Poison Black Cherry, Dwale; Fr. Belladone, Morelle furieuse, Feuilles de Belladone, Racine de Belladone; Ger. Toll (Wolf's) Kirsche, Tollkraut, Belladonna, Belladonna-blätter, Belladonnawurzel.

*At'ro-pa.* L. fr. Gr. Ἀτροπος = *à*, priv., + *τρέπειν*, to turn—not to turn, to be inflexible. One of the mythological fates, whose office it was to cut the thread of life. With this poisonous fruit or plant the functions of office could easily be performed.

*Bel-la-don'na.* L. *bella*, beautiful, + *donna*, a lady—i. e., the berries were used by the Italian ladies as a cosmetic, and to dilate their eye pupils, thus giving them a strikingly handsome appearance.

**PLANT.**—Bushy perennial, 1–1.5 M. (3–5°) high; stems thick, smooth, purplish; flowers June–July, 2.5 Cm. (1') long, dark purple, bell-shaped, in 5's; fruit Sept., purplish-black, berries size of a cherry. Grows in stony, shady, bushy places, along walls, amid rubbish, preferring chalk and limestone soil. All parts are active, and this applies equally to the cultivated and the wild-grown plants. **LEAVES**, usually dull brownish-green, much wrinkled and matted together, with flowering tops, 6–20 Cm. (2.5–8') long, 4–12 Cm. (1½–4.5') broad, broadly ovate, acute, entire, narrowed into the petiole, lower surface grayish-green, epidermis more or less papillose, especially underneath; odor narcotic, more so on moistening; taste bitter, acrid; powder brownish-green, few hairs, many small, arrow-shaped crystals of calcium oxalate. Should be collected June–July, while in flower, from plants between 2 and 4 years old. Dose, gr. ½–3 (.03–.2 Gm.).

FIG. 349.

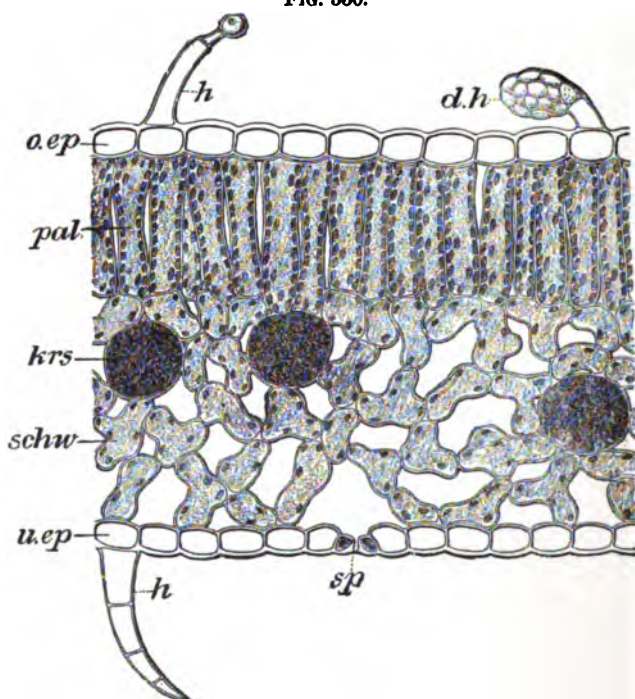


*Atropa Belladonna*: branch, fruit, seed, and section of seed, the last two magnified.



Root, in cylindrical or somewhat tapering, longitudinally wrinkled pieces, 10–30 Cm. (4–12') long, 1–2.5 Cm. ( $\frac{2}{5}$ –1') thick, bark somewhat incurved on split edges, pale brownish-gray, dusty or mealy, outer layers of periderm rather soft, often abraded, showing lighter patches, fracture nearly smooth, mealy, emitting a characteristic puff of dust; internally whitish, the older roots showing medullary rays near bark; nearly inodorous; taste sweetish, bitterish, acrid; powder pale gray, few sclerenchymatous fibres, numerous starch grains, single or 2–3-compound; roots, which are tough, woody, breaking with splintery fracture, and the hollow stem-bases should be rejected. The roots should

FIG. 350.



Belladonna leaf cross-section: *o.ep*, upper epidermis with a glandular hair having long stem with little head (*h*), and a very short-stemmed glandular hair with large many-celled head (*d.h*); *pal*, palisade tissue; *krs*, sand-crystal cell; *schw*, spongy parenchyma; *u.ep*, lower epidermis with stomata (*sp*), and a single multicellular hair (*h*), magnified 175 diam.

always be collected in autumn or early spring, from plants 2–4 years old—if younger the fracture is horny, resinous, if older then woody, splintery, in both cases containing less alkaloids; the English is considered more reliable than the German. *Solvents*: diluted alcohol or alcohol (65 p. c.); hot water partially. Dose, gr.  $\frac{1}{2}$ –2 (.03–1.3 Gm.).

**ADULTERATIONS.**—**LEAVES**: Sometimes leaves of digitalis, hyoscyamus, stramonium, verbascum, all of which are hairy, more or less lobed, differently colored and veined; *Solanum ni'grum*, black nightshade, leaves smaller, dentate; *Scopola carniolica*, leaves oblong-ovate, with-

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out stomata on the upper surface, contain scopalamine, which is a mydriatic equal to atropine, but without irritating properties; *Phytolacca decandra*, leaves easily detected by epidermal cells being more angular. ROOT: Occasionally—roots of allied species, scopola—darker, less dusty, transverse root-scars, *Medicago sativa*, which has solid crown-branches and thinner bark, and sometimes with pokeroor. The roots of inula, spikenard, and parsley have similar appearance.

CONSTITUENTS.—Atropine, 0.2–0.6 p. c., Belladonnine, Hyoscyamine, scopalamine, atropamine, atosin, malic acid, starch; leaves have, in addition: choline (bilineurine), albumin, mucilage, wax, asparagin, chrysotropic acid (scopoletin), succinic acid, nitrates, ash 14 p. c. (= Ca, Mg, K, carbonates).

**Atropina, Atropine**,  $C_{17}H_{23}NO_3$ , *official*.—(Syn., Atropia; Fr. Atropine; Ger. Atropinum, Atropin.) This alkaloid in commerce always contains a little hyoscyamine, which is separated with difficulty, as they are extracted together by agitating an alcoholic tincture of the root with slaked lime, in order to decompose the natural salt and liberate the alkaloid, which remains in solution; acidify filtrate with diluted sulphuric acid, concentrate to remove alcohol, fat, resin, and to the filtrate add potassium carbonate in excess; purify by dissolving this washed precipitate (atropine) in alcohol, and adding water until slightly turbid, then allow to crystallize. It occurs in white rhombic prisms, odorless, bitter, acid, soluble in 450 parts water, 1.46 alcohol, 16.6 ether, 1.56 chloroform, no residue; forms numerous salts (hydrobromide, hydrochloride, nitrate, sulphate, etc.). *Tests*: 1. Heated with barium hydroxide becomes hydrolized into tropic acid,  $C_9H_{10}O_3$ , and tropine,  $C_8H_{12}NO$ ,—tropine tropate—and by heating these together synthetic atropine results; other tropeines (alkaloids, compound esters) have been formed with various organic acids, as tropine mandelate, which yields homatropine. 2. Adding crystal to few drops sulphuric acid containing 1 drop creosol gives pink color, not dissipated by 0.5 Gm. hydrated chloral (dis. from other alkaloids—hyoscyamine producing brown, strychnine black, hyoscyne remaining colorless). 3. To solution in hydrochloric acid add platinic chloride T. S., get no precipitate (dif. from most alkaloids); gold chloride T. S. yields yellow, lustreless precipitate.

*Impurities*: Other alkaloids—morphine, hyoscyamine, hyoscyne, strychnine, readily carbonizable substances. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{120}$ — $\frac{1}{60}$  (.0005–.001 Gm.).

**Atropinæ Sulphas, Atropine Sulphate**,  $(C_{17}H_{23}NO_3)_2H_2SO_4$ , *official*.—(Syn., Sulphate of Atropia; Fr. Sulfate d'Atropine; Ger. Atropinum sulfuricum, Atropinsulfat, Schwefelsaures Atropin.) Obtained by dissolving atropine mixed with water by means of diluted sulphuric acid, neutralizing, evaporating, or dissolve in alcohol, neutralize with sulphuric acid, evaporate; as such is usually accompanied by small

FIG. 351.



Belladonna root: transverse section, magnified 3 diam.

amount of hyoscyamine sulphate, from which it cannot readily be separated. It occurs as a white crystalline powder or microscopical needles and prisms, odorless, bitter, nauseating taste, permanent, soluble in 0.38 part water, 3.7 alcohol, 2,140 ether, 620 chloroform, no residue. *Test*: 1. With potassium hydroxide T. S. get white precipitate of atropine, which responds to its tests. Dose, gr.  $\frac{1}{20}$ — $\frac{1}{60}$  (.0005–.001 Gm.).

**Homatropinæ Hydrobromidum, Homatropine Hydrobromide**,  $C_{16}H_{21}NO_3HBr$ , *official*.—(Syn., Fr. Bromhydrate d'Homatropine; Ger. Homatropinum Hydrobromicum, Bromwasserstoffsäures Homatropin (Oxytoluyltropine).) Obtained by heating tropine,  $C_8H_{15}NO$ , with either mandelic (phenylglycolic) acid or oxytoluic (phenyl-acetic) acid, in the presence of hydrochloric acid; add ammonia, shake out with chloroform the homatropine thus liberated, evaporate chloroformic solution, neutralize with hydrobromic acid, crystallize. It is a white, odorless, crystalline powder, or rhombic prisms, bitter, soluble in 5.7 parts water, 32.5 alcohol, 620 chloroform, melts at  $214^\circ C.$  ( $417^\circ F.$ ), no residue. *Tests*: 1. Aqueous solution (1 in 10) shaken with chloroform 2 Cc. + few drops chlorine water imparts brownish color to chloroform. 2. Aqueous solution + iodine T. S. gives brown precipitate; + silver nitrate T. S. a creamy white precipitate. 3. Evaporate to dryness 0.01 Gm. + 5 drops nitric acid, residue should not acquire violet color with few drops alcoholic potassium hydroxide T. S. (abs. of atropine, hyoscyamine, hyoscyne). Superior to atropine in that it is less toxic, decreases instead of increases heart-rate and blood-pressure, and the effects pass off in one-fourth the time—1–2 days; inferior to atropine where lasting mydriasis is desired. Used to correct anomalies of refraction, in 1–2 p. c. solutions. Dose, gr.  $\frac{1}{20}$ — $\frac{1}{60}$  (.0005–.001 Gm.).

**Belladonnine**,  $C_{17}H_{23}NO_4$ , **Oxyatropine** and **Atropamine** (Apo-atropine),  $C_{17}H_{21}NO_2$ .—All these may be one and the same; yellow powder decomposed very easily by mineral acids.

**Hyoscyamine**, (daturine, duboisine of other plants).—This has the same formula as atropine and hyoscyne, but is more soluble in water and diluted alcohol, and forms gold salts with a different fusing-point; is converted into atropine by alkalis in alcoholic solution.

**Atrosin**.—This is the red coloring matter, fluorescent.

**Malic Acid**.—This holds the alkaloids in combination.

The young roots contain only hyoscyamine, those of 8–10 years old also atropine; alkaloids are mostly in the bark, hence large woody roots should be rejected.

**Assay**: Leaves and Root—Exhaust fine powder 10 Gm., with alkaline (ammonia water 2 Cc.) solution of chloroform (1 part) and ether (4) 50 Cc., shake out tincture with normal sulphuric acid V. S. (6, 10), transfer the separated acid solutions to a separator, make alkaline with ammonia water, shake out with chloroform 15, 15, 5, evaporate chloroform solutions to dryness, dissolve residue in excess  $\frac{N}{10}$  sulphuric acid V. S., titrate excess of acid with  $\frac{N}{50}$  potassium hydroxide V. S., using hæmatoxylin or iodeosin T. S. indicator; divide Cc. of  $\frac{N}{50}$  potas-

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sium hydroxide V. S. by 5, subtract quotient from 3, multiply remainder by 0.0287, and product by 10 = p. c. mydriatic alkaloids present, or from amount of  $\frac{N}{10}$  sulphuric acid V. S. found to have been neutralized by the alkaloidal principles, the p. c. present is calculated, each Cc.  $\frac{N}{10}$  sulphuric acid V. S. corresponds to 0.0287 Gm. of mydriatic alkaloids.

**PREPARATIONS.**—I. **LEAVES:** 1. *Extractum Belladonnæ Foliorum*. Extract of Belladonna Leaves. (Syn., *Extractum Belladonnæ Foliorum Alcoholicum*, U. S. P. 1890; Fr. *Extrait de Belladone alcoolique*; Ger. *Belladonnaextrakt*, *Spirituöses Tollkirschenextrakt*.)

*Manufacture:* Macerate, percolate 100 Gm. with alcohol 65 p. c., evaporate; yield about 22 p. c. Should contain 1.4 p. c. of mydriatic alkaloids. *Assay:* Dissolve extract (5) in alcohol (5), distilled water (10), ammonia water (2) and chloroform (20), shake in a separator, pour off chloroformic layer, shake with chloroform (10, 10), mix chloroformic solutions, and proceed approximately as in assay of belladonna leaves. Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.016–.03 Gm.).

*Preps.:* 1. *Emplastrum Belladonnæ*. Belladonna Plaster. (Syn., Fr. *Emplâtre de Belladone*; Ger. *Belladonnapflaster*.)

*Manufacture:* Melt adhesive plaster 70 Gm., add extract of belladonna leaves 30 Gm., softened by heat, stir until homogeneous, cool; should contain 0.38–0.42 p. c. of mydriatic alkaloids. *Assay:* Dissolve strips of plaster (10) in chloroform (100) and ammonia water (4), dry the cloth, subtract its weight from original; to chloroformic solution add four-fifths volume of alcohol, when rubber has separated pour liquid into separator, and proceed approximately as in assay of belladonna leaves and root, using  $\frac{3}{8}$  normal sulphuric acid V. S.

2. *Unguentum Belladonnæ*. Belladonna Ointment. (Syn., Fr. *Pomatum cum Extracto Belladonnæ*; Ger. *Tollkirschensalbe*.)

*Manufacture:* Rub extract of belladonna leaves 10 Gm. with diluted alcohol 5 Cc. until homogeneous, incorporate hydrous wool-fat 20, add benzoinated lard 65, mix thoroughly.

3. *Pilulæ Laxativæ Compositæ*,  $\frac{1}{8}$  gr. (.008 Gm.). 4. *Pilulæ Podophylli, Belladonnæ et Capsici*,  $\frac{1}{8}$  gr. (.008 Gm.).

2. *Tinctura Belladonnæ Foliorum*. Tincture of Belladonna Leaves. (Syn., Br. *Tinctura Belladonnæ*; Fr. *Teinture de Belladone*; Ger. *Belladonnatinktur*.)

*Manufacture:* 10 p. c. Macerate, percolate 10 Gm. with diluted alcohol q. s. 100 Cc.; when assayed each 100 Cc. should contain 0.035 Gm. of mydriatic alkaloids. *Assay:* Evaporate tincture 100 Cc. to 10 Cc., and proceed approximately as in assay of the fluidextract, except omitting the multiplication of product by 10. Dose,  $\mathfrak{m}\text{j}$ –30 (.06–2 Cc.).

II. **ROOT:** 1. *Fluidextractum Belladonnæ Radicis*. Fluidextract of Belladonna Root. (Syn., *Extractum Belladonnæ Radicis Fluidum* U. S. P. 1890; Br. *Extractum Belladonnæ Liquidum*; Fr. *Extrait liquide de Racine de Belladone*; Ger. *Flüssiges Tollkirschenwurzel-extrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 80 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.5 Gm. of mydriatic alkaloids. **Assay:** To 10 Cc. add distilled water 10, chloroform 20, ammonia water 2, shake, draw off chloroformic layer, shake with chloroform 10, 10, mix chloroformic solutions, and proceed approximately as in assay of belladonna leaves. Dose, ℥j-5 (.06-.3 Cc.).

Prep.: 1. *Linimentum Belladonnæ*. Belladonna Liniment. (Syn., Fr. Liniment de Belladone; Ger. Belladonnaliniment.)

**Manufacture:** Dissolve camphor 5 Gm. in fluidextract of belladonna root q. s. 100 Cc. Used externally.

III. ATROPINE: 1. *Oleatum Atropinæ*. Oleate of Atropine. (Syn., Atropinum Oleicum; Fr. Oléate d'Atropine; Ger. Atropinoleat.)

**Manufacture:** Triturate atropine (alkaloid) 2 Gm. with alcohol 2 Cc., add oleic acid 2 Gm., warm mortar, stir until alcohol evaporated, add oleic acid 48 Gm., stir until atropine dissolved, add olive oil q. s. 100 Gm. Used externally.

**Unoff. Preps.:** I. LEAVES: *Extractum Belladonnæ Viride* (Br.), express juice, heat, strain, evaporate, add coloring matter strained out, dose, gr.  $\frac{1}{4}$ -1 (.016-.06 Gm.). *Succus Belladonnæ* (Br.), expressed juice 3 parts + alcohol 1, dose, ℥5-15 (.3-1 Cc.). *Fluidextract*, dose, ℥ $\frac{1}{3}$ -3 (.02-.2 Cc.). *Infusion*, 5 p. c., dose, ʒj-3 (4-12 Cc.). II. ROOT: *Abstract*, dose, gr.  $\frac{1}{10}$ -1 (.006-.06 Gm.). *Extract*, dose, gr.  $\frac{1}{8}$ - $\frac{1}{2}$  (.008-.03 Gm.). *Suppositoria Belladonnæ* (Br.), each contains extract 1 $\frac{1}{2}$  gr. (.1 Gm.). *Unguentum Atropinæ* (Br.), 2 p. c. *Lamellæ Atropinæ* (Br.), each contains  $\frac{1}{8000}$  gr. (.000013 Gm.). *Lamellæ Homatropinæ* (Br.), each contains  $\frac{1}{1000}$  gr. (.0006 Gm.).

**PROPERTIES.**—Sedative, narcotic, diuretic, mydriatic, antispasmodic, anodyne. Like all medicines that act through nervous system, small doses stimulate, large ones paralyze. Diminishes most secretions (salivary, mammary, skin, stomach, liver, pancreas, intestines) by paralyzing peripheral nerve-endings, increases peristalsis by paralyzing terminations of involuntary intestinal muscles; dilates pupil, increases pulse and urine by paralysis; often causes erythematous eruption.

**USES.**—Lessens pain, rheumatism, gout, neuralgia, sciatica, cancer, pelvic derangements, encephalitis, meningitis, myalitis, erysipelas. Inflammation of lungs, iris, bladder, kidneys, breast, acute catarrh, sore throat, asthma, whooping-cough, spasms, constipation, spermatorrhœa, prophylactic against scarlet fever. Locally in abscesses, carbuncles, skin diseases, scarlet fever rash, to check mammary secretion, relieve vomiting of pregnancy. Smoke leaves with opium for phthisis. Atropine (hypodermic) is the sheet-anchor in poisoning by opium, physostigma, and hydrocyanic acid.

**Poisoning:** Within 15 minutes have dryness of mouth, dry burning throat, dilated pupils, intense thirst which nothing allays, indistinct and double vision, giddiness, burning in stomach, nausea, difficult deglutition, hallucinations, delirium or fits of laughter, rambling talk, feeble and rapid pulse, cold extremities, coma, convulsions, death; sometimes

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face red and swollen, inability to urinate. Give emetics or use pump, enemas, tannic acid, then morphine, physostigmine, or pilocarpine (hypodermic) for nervous disturbance; stimulants, brandy, caffeine, strychnine, artificial respiration, cold to head, warmth to feet, empty bladder. Children often eat the sweet fruit in excess, and should receive this treatment.

*Incompatibles*: Muscarine, physostigmine, pilocarpine, aconite, opium, tannin, caustic alkalies (evolve ammonia), quinine.

*Synergists*: Mydriatic drugs (hyoscyamus, stramonium, duboisia).

*Allied Plants*:

1. *Mandrag'ora officina'lis* (*Atropa mandragora*), together with var. *autumna'lis*, having blue flowers, and var. *verna'lis*, white flowers. S. Europe. These are acaulescent plants, having constituents similar to those of belladonna.

**SCOPOLA. SCOPOLA.**

**Scopola** } The dried rhizome, containing 0.5 p. c. of alka-  
**carniolica, Jacquin.** } loids.

*Habitat.* C. Europe—Germany (Bavaria), Austro-Hungary (Carniola, Croatia, etc.), S. W. Russia; hilly, mountainous districts.

*Syn.* *Atropa carniolica*, *Hyoscyamus Scopolia*, *Scopolina thichotoma*, *Belladonna scopolia*.

**SCO-po'la.** L. In honor of John A. Scopoli, Austrian naturalist, author, and professor, eighteenth century.

**Car-ni-ol'i-ca.** L. *carniolicus*, of or pertaining to Carniola, an Austrian province—i. e., the plant's habitat.

**PLANT.**—Erect shrub, usually branchless, 20–60 Cm. (8–24') high; leaves alternate, oblong-lanceolate, slightly wavy or notched toward apex, petiolate, prominently reticulated and veined; flowers tubular, bell-shaped, brownish-purple, 25 Mm. (1') long, 5's; fruit circumscissile, dehiscent capsule. **RHIZOME**, of horizontal growth, more or less curved, shortly and sharply flexuous, cylindraceous, somewhat flattened vertically, mostly in pieces 2.5–7.5 Cm. (1–3') long, 0.8–1.6 Cm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') thick, often split before drying; upper surface with large, closely set cup-shaped stem-scars, margins irregularly contracted, yellowish-brown to dark brownish-gray, finely and irregularly wrinkled longitudinally, obscurely annulate, more or less nodular-roughened, fracture short, sharp, exhibiting yellowish-white bark, its corky layer brownish, wood indistinctly radiate, central pith rather horny; nearly inodorous; taste sweetish, bitterish, strongly acid. *Solvents*: alcohol (80 p. c.); water partially. Dose, gr. 1–3 (.06–.2 Gm.).

**Commercial.**—Plant grows in damp stony places, among bushes or calcareous soil; resembles belladonna in shape of leaves, color and position of flowers, branching of stem, etc., but differs in size (smaller), fruit (pyxis), foliage (leaves thinner, more reticulated), and in possessing a rhizome. This rhizome grows rapidly in length and thickness until a certain diameter is reached, when its thickness practically ceases, but length continues, thereby giving a rhizome almost uniform in cortical portion, in which the alkaloids reside; in the case of belladonna,

the root is of irregular thickness, hence woody cylinder grows so much faster than the bark that the alkaloidal strength varies greatly. In belladonna young roots have only hyoscyamine, old roots (8–10 years) have also atropine, into which the hyoscyamine is converted in the process of manufacturing, whereas scopolamine is unchanged.

FIG. 352.



*Scopolia carniolica*: a, flowering and fruiting branch ( $\frac{1}{2}$  nat. size); also flower, stamen, anther, pistil, fruit, seed, enlarged.

**CONSTITUENTS.**—Total alkaloids 0.59 p. c.: Hyoscyamine 0.5 p. c., Atropine, Scopolamine 0.05, scopoletin.

**Scopolamine**,  $C_{17}H_{21}NO_4 \cdot H_2O$ .—Found also in belladonna, hyoscyamus, stramonium, and duboisia—considered to be identical with hyoscyne, being a tertiary base; occurs in stable transparent crystals, melting at  $59^\circ C.$  ( $138^\circ F.$ ) to a colorless liquid, which does not again crystallize upon standing; the crystals kept over sulphuric acid gradually change to an amorphous, glassy mass, which will not crystallize. It is decomposed by baryta into scopoline ( $C_8H_{13}NO_2$ ) and atropic acid ( $C_9H_8O_2$ ); scopoline, the hydrolytic product of scopolamine, is not identical with tropine,  $C_8H_{15}NO$ , but is a crystalline base distilling at  $242^\circ C.$  ( $468^\circ F.$ ) without decomposition, solidifies to a crystalline mass, which, recrystallized from ligroin, forms colorless needles melting at  $110^\circ C.$  ( $230^\circ F.$ ).

**Scopolaminæ Hydrobromidum, Scopolamine Hydrobromide**,  $C_{17}H_{21}NO_4 \cdot HBr + 3H_2O$ , *official.*—(Syn., Scopolamine Hydrobromate;

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Br. Hyoscinæ Hydrobromidum; Fr. Bromhydrate d'Hyoscine; Ger. Scopolaminum hydrobromicum, Skopolaminhydrobromid.) Chemically identical with hyoscine hydrobromide; thought to consist of two bases—hyoscine and atosine (optically inactive scopolamine); occurs in colorless hygroscopic crystals, soluble in water, alcohol. Dose, gr.  $\frac{1}{150}$ – $\frac{1}{60}$  (.00025–.001 Gm.), injection.

**Assay:** Identical with that of belladonna leaves, page 542, using scopol 10 Gm.

**PREPARATIONS.**—1. *Fluidextractum Scopolæ*. Fluidextract of Scopol. (Syn., Fr. Extrait liquide de Racine de Scopol; Ger. Flüssiges Skopolawurzelextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 80 p. c. q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.5 Gm. of mydriatic alkaloids. **Assay:** Identical with that of fluid-extract of belladonna. Dose, Mj–3 (.06–.2 Cc.).

**Prep.:** 1. *Extractum Scopolæ*. Extract of Scopol. (Syn., Fr. Extrait de Racine de Scopol; Ger. Skopolawurzelextrakt.)

**Manufacture:** Evaporate cautiously to pilular consistence fluidextract of scopol 100 Cc.; when assayed should contain 2 p. c. of mydriatic alkaloids, and any excess of strength must be reduced with sufficient sugar of milk. **Assay:** Identical with that of extract of belladonna, except use 2 Gm. extract of scopol; yield 18–20 p. c. Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.016–.03 Gm.).

**Unoff. Preps.:** *Hypodermic Solutions* (mydriatic); those of scopolamine  $\frac{1}{10}$ – $\frac{1}{5}$  p. c., correspond to atropine solutions  $\frac{1}{2}$ –1 p. c.

**PROPERTIES.**—Mydriatic, analgesic, hypnotic, antiphlogistic. Dilates pupil, paralyzes accommodation, contracts vessels of the iris and ocular conjunctiva, excites vasomotor centre, elevates blood-pressure, diminishes brain excitability, secretion of saliva and sweat; has no effect on respiration nor upon striated muscular tissue, and is eliminated rapidly in the urine. Differs physiologically from atropine in having a paralyzing action on the brain, in retarding (not accelerating) the pulse, in being 5 times stronger, and in having no unfavorable sequelæ; also superior to it as well as hyoscyamine in that scopolamine does not occasion dryness of the throat and redness of the face.

**USES.**—Glaucoma, ptialism, hyperidrosis; scopolamine hydrochloride solutions  $\frac{1}{10}$ – $\frac{1}{5}$  p. c., in ophthalmology; hypodermic injections, gr.  $\frac{1}{250}$ – $\frac{1}{60}$  (.00025–.001 Gm.), for the insane. Should not be given in renal affections nor in advanced age.

**Poisoning:** Similar to belladonna; give emetics or use pump; muscarine, tannin, animal charcoal, cathartic, etc.

**Incompatibles:** Similar to other alkaloids, morphine, etc.

**Allied Plant:**

1. *Scopola, japon'ica, Japanese Belladonna.*—Plant resembles very closely *S. carniolica*, differing only in having the style curved, calyx-teeth unequal, leaves less obovate with longer petioles; rhizome 10 Cm. (4') long, 12 Mm. ( $\frac{1}{2}$ ') thick; this also yields atropine, scopolamine, etc.



## HYOSCYAMUS. HYOSCYAMUS.

**Hyoscyamus** { The dried leaves and flowering tops, collected from  
**niger**, Linné. { plants of the second year's growth, containing 0.08  
 p. c. of mydriatic alkaloids.

*Habitat.* Europe, Asia, waste places, neglected ruins, old gardens, sandy soil; naturalized in N. America (New England to Michigan); cultivated in England, etc.

*Syn.* Henbane, Hog's-bean, Poison Tobacco, Stinking or Fetid Nightshade, Insane-root, Belene, Chenile, Henbell, Black Henbane; Br. *Hyoscyami Folia*; Fr. *Jusquiame noir*, *Feuilles de Jusquiame noire*; Ger. *Herba Hyoscyami*, *Bilsenkrautblätter*.

**Hy-os-cy'a-mus.** L. fr. Gr. *ὕος*, a hog, + *κίανος*, a bean, hog bean—*i. e.*, its fruit (bean) acts on swine as a poison or intoxicant, but cows, horses, dogs, and goats can tolerate great quantity.

*Ni'ger.* L. black—*i. e.*, inside throat of flowers purplish-black.

*Hen'bane.* *Hen* + *bane*—*i. e.*, whole plant fatal to poultry—bane to hens.

**PLANT.**—Biennial herb; stem .6–1.3 M. (2–4°) high, green, rises in second year, covered with long, soft, jointed, glandular, white hairs, viscid, clammy, fetid odor; root large, brown, inside white, resembles parsley (for which it has been eaten, with serious results), wrinkled, com-

FIG. 353.

*Hyoscyamus niger*: flowering branch.

FIG. 354.

*Hyoscyamus* calyx, containing capsule, natural size.

pact, fibrous. **LEAVES**, ovate or ovate-oblong, the lower with short petiole, upper sessile, 5–25 Cm. (2–10') long, 2–10 Cm. ( $\frac{1}{2}$ –4') broad, acute, coarsely and angularly toothed or lobed, grayish-green, glandular-hairy, particularly on lower surface, midrib prominent; flowers May–June, nearly sessile, with urn-shaped (urceolate), unequally 5-toothed calyx, yellowish, campanulate, purple net-veined corolla, about 3 Cm. ( $1\frac{1}{2}$ ') long, anthers and style purple; fruit capsular, pyxis, 12 Mm. ( $\frac{1}{2}$ ') thick, globular, 2-celled, enclosed in calyx, dehiscing near top by a cap, seeds

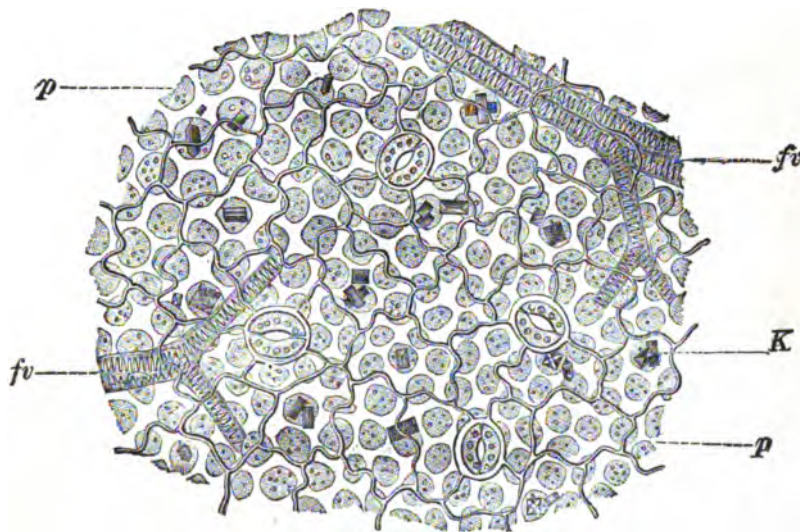
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many, black; odor heavy, narcotic; taste somewhat bitter, nauseous; powder grayish-green, containing calcium oxalate in single or twin monoclinic prisms. *Solvents*: diluted alcohol; boiling water partially. Dose, gr. 2–10 (.13–.6 Gm.).

**ADULTERATIONS.**—Leaves of allied species, also of stramonium, digitalis, belladonna, verbasum.

**Commercial.**—Leaves should be collected when two-thirds of the flowers are expanded. The plant by cultivation has become so diversified as to give varieties and almost species, all differing somewhat in medicinal properties; the annual form of plant is usually .3–.6 M. (1–2°) high, having smaller parts, leaves less toothed, corolla faintly or not purple-veined; the biennial form during first year produces a fleshy fusiform root and a radical rosette of large leaves, coarsely toothed or

FIG. 355.



*Hyoscyamus*: view of upper side of leaf revealing through epidermis the stomata and crystals (*K*) and palisade cells (*p*), and fibrovascular bundles.

lobed, long petioles, and in second year has the flowering and fruiting stem, after which it dies; in this latter stage the root becomes spongy, hollow, radical leaves are wanting, those of the stem being broader with shorter petioles, sessile at apex. While stem leaves of the biennial plant are considered generally stronger, yet those of the first year, as also those of annual plant, are often of equal strength; the perfect biennial root is three times richer than any other portion.

**CONSTITUENTS.**—Mydriatic alkaloids 0.3–0.557 p. c.: Hyoscyamine, Hyoscyne, Scopolamine, Hyoscyipicrin, choline, mucilage, albumin, potassium nitrate 2 p. c. In the seeds also fixed oil 25 p. c.

**Hyoscyamine.**  $C_{17}H_{23}NO_3$ .—A crystalline alkaloid obtained from the mother-liquors of atropine, or by freeing hyoscyamus seeds of fat by petroleum ether, drying, exhausting with alcohol (85 p. c.), adding

hydrochloric acid, reclaiming alcohol ; treat filtered residue again with petroleum ether (fat, coloring matter), render alkaline with ammonia or potassium carbonate, shake with repeated portions of chloroform, evaporate chloroformic solution, purify by solution in dilute sulphuric acid, filter, crystallize ; to obtain alkaloid render aqueous solution alkaline, extract with chloroform, evaporate ; yield—leaves : 0.042–0.224 p. c. ; seed : 0.08–0.16 p. c. ; root : 0.006–0.307 p. c. Occurs in white silky needles ; if impure, deliquescent, becoming brown ; identical with duboisine, isomeric with atropine, into which it is converted by heating to  $120^{\circ}$  C. ( $248^{\circ}$  F.) for 6 hours ; it also splits into tropine,  $C_8H_{15}NO$ , and tropic acid,  $C_9H_{10}O_3$ , and forms numerous salts (hydrobromide, hydrochloride, sulphate, etc.).

**Hyoscyaminæ Hydrobromidum, Hyoscyamine Hydrobromide**,  $C_{17}H_{23}NO_3 \cdot HBr$ , *official*.—(Syn., Hyoscyaminæ Hydrobromas, U. S. P. 1890 ; Fr. Bromure d'Hyoscyamine ; Ger. Hyoscyaminum hydrobromicum, Hyoscyaminbromid.) This hydrobromide of the preceding alkaloid is obtained by dissolving 10 parts hyoscyamine in slight excess of diluted hydrobromic acid, 11 parts, 25 p. c., concentrating, crystallizing ; it is in white, prismatic crystals, or yellowish, amorphous, resin-like mass, tobacco-like odor, acrid, nauseous, bitter taste, deliquescent, soluble in water, 2 parts alcohol, 1,600 ether, 2.5 chloroform, no residue. *Tests* : 1. Aqueous solution is not precipitated by platinic chloride T. S. (dif. from most alkaloids). 2. With gold chloride T. S. gives precipitate, which when crystallized from boiling acidulated (HCl) water is in minute, lustrous, golden-yellow scales (dif. from atropine). 3. With silver nitrate T. S. get yellowish-white precipitate insoluble in nitric acid, soluble in ammonia water. Dose, gr.  $\frac{1}{120}$ – $\frac{1}{60}$  (.0005–.001 Gm.).

**Hyoscyaminæ Sulphas, Hyoscyamine Sulphate**,  $C_{17}H_{23}NO_3 \cdot H_2SO_4$ , *official*.—(Syn., Fr. Sulfate d'Hyoscyamine ; Ger. Hyoscyaminum sulfuricum, Schwefelsaures Hyoscyamin.) This neutral sulphate is obtained by dissolving hyoscyamine in diluted sulphuric acid to neutrality, concentrating, crystallizing ; it is in white, indistinct crystals or powder, odorless, bitter, acrid, deliquescent, soluble in water, 6.4 parts alcohol, 2,500 ether, 2,300 chloroform, no residue. *Tests* : 1. To aqueous solution add gold chloride T. S., get precipitate, which when recrystallized from boiling acidulated (HCl) water is in minute, lustrous, golden-yellow scales (dif. from atropine). 2. With platinic chloride T. S. get no precipitate (dif. from most alkaloids) ; sulphuric acid should produce no color (abs. of carbonizable substances). Both salts should be kept in amber-colored, well-stoppered vials. Dose, gr.  $\frac{1}{120}$ – $\frac{1}{60}$  (.0005–.001 Gm.).

**Hyoscine (Amorphous Hyoscyamine)**,  $C_{17}H_{21}NO$ .—Isomeric with and considered to be identical with scopolamine and duboisine ; obtained from mother-liquor of hyoscyamine, by adding gold chloride, to form a less soluble gold double salt, which crystallizes out ; dissolve this in water, remove gold by hydrogen sulphide, precipitate hyoscine with potassium carbonate ; it is a tenacious semi-liquid mass,

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isomeric with hyoscyamine, yields tropic acid and pseudotropine,  $C_8H_{15}NO$ , and forms numerous salts (hydrobromide, hydrochloride, sulphate, etc.).

**Hyoscinæ Hydrobromidum, Hyoscine Hydrobromide**,  $C_{17}H_{21}NO_4 \cdot HBr + 3H_2O$ , *official*.—(Syn., Hyoscinæ Hydrobromas, U. S. P. 1890; Fr. Bromure (Bromhydrate) d'Hyoscine; Ger. Hyoscinum Hydrobromicum, Hyoscinhydrobromid, Skopolaminhydrobromid.) This hydrobromide of the preceding alkaloid is obtained by dissolving it in slight excess of diluted hydrobromic acid, concentrating, crystallizing; it is in colorless, transparent, rhombic crystals, odorless, acrid, bitter taste, slightly efflorescent, soluble in 1.5 parts water, 16 alcohol, 750 chloroform, insoluble in ether, no residue. *Tests*: 1. Shake 1 Cc. solution (1 in 10) with 2 Cc. chloroform, + few drops chlorine water, get brownish color. 2. Evaporate 0.01 Gm. + 5 drops nitric acid, residue yields violet color with alcoholic potassium hydroxide T. S. 3. Silver nitrate T. S. gives yellowish-white precipitate; sulphuric acid should give no color, + nitric acid no color (abs. of morphine). Should be kept in amber-colored, well-stoppered vials. Dose, gr.  $\frac{1}{200}$ — $\frac{1}{100}$  (.0003–.0006 Gm.); hypodermically, gr.  $\frac{1}{400}$ — $\frac{1}{200}$  (.00015–.0003 Gm.).

**Scopolamine**,  $C_{17}H_{21}NO_4$ .—Isomeric with hyoscine, amorphous or crystalline, forms useful salts, splits into atropic acid,  $C_9H_9O_2$ , and scopoline,  $C_8H_{13}NO_2$ .

**Hyoscipicrin**,  $C_{27}H_{32}O_{14}$ .—A neutral, bitter glucoside, soluble in water, alcohol, precipitated by tannin, converted by hydrochloric acid into fermentable sugar, and a yellowish, acrid, bitter resin.

**Assay**: Identical with that of belladonna leaves, except 25 Gm. (not 10) are used, and 100 Cc. (not 50 Cc.) of chloroform-ether mixture are first added, and product is multiplied by 4 (not 10).

**PREPARATIONS**.—1. *Fluidextractum Hyoscyami*. Fluidextract of Hyoscyamus. (Syn., Extractum Hyoscyami Fluidum, U. S. P. 1890; Fr. Extrait liquide de Jusquiame; Ger. Flüssiges Bilsenkrautextrakt.)

**Manufacture**: Macerate, percolate 100 Gm. with alcohol 65 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.075 Gm. of alkaloids. **Assay**: Identical with that of fluidextract of belladonna root, using 50 Cc. instead of 10, and multiplying product by 2 instead of 10. Dose, Mij—10 (.13–.6 Cc.).

**Prep.**: 1. *Extractum Hyoscyami*. Extract of Hyoscyamus. (Syn., Extract of Henbane; Fr. Extrait Alcoolique (de Feuilles) de Jusquiame; Ger. (Spirituoses) Bilsenkrautextrakt.)

**Manufacture**: Evaporate cautiously to pilular consistence fluidextract of hyoscyamus 100 Cc.; yield 20–25 p. c. When assayed by process given for extract of belladonna, page 542 (using 10 Cc. instead of 5, and multiplying product by 10 instead of 20), should contain 0.3 p. c. of mydriatic alkaloids, and any excess of strength must be reduced with sufficient sugar of milk.

Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

2. *Tinctura Hyoscyami*. Tincture of Hyoscyamus. (Syn., Fr. Teinture de Jusquiame; Ger. Bilsenkrauttinktur.)

**Manufacture:** 10 p. c. Macerate, percolate 10 Gm. with diluted alcohol q. s. 100 Cc.; when assayed each 100 Cc. should contain 0.007 Gm. of mydriatic alkaloids. **Assay:** Evaporate 100 Cc. to 10 Cc., and proceed approximately as in assay of fluidextract of belladonna root, except omitting the multiplication of product by 10. Dose, 3ss–1 (2–4 Cc.).

**Unoff. Preps.:** *Extractum Hyoscyami Viride* (Br.), express juice, heat, strain, evaporate, add coloring matter strained out, dose, gr. 2–8 (.13–.5 Gm.). *Succus Hyoscyami* (Br.), express juice 3 parts, alcohol 1, dose, 3ss–1 (2–4 Cc.). *Abstract* (alcohol), dose, gr. 1–5 (.06–.3 Gm.). *Infusion*, 5 p. c., dose, 3j–3 (4–12 Cc.). *Oleum Hyoscyami Infusum* (leaves 1, alcohol 2, olive oil 20); use externally. *Baume Tranquille* (leaves of hyoscyamus, stramonium, belladonna, tobacco, poppy, black nightshade, ãã 40 parts + aromatic herbs 12 kinds ãã 10 + olive oil 1,000); used externally.

**PROPERTIES.**—Anodyne, hypnotic, narcotic, mydriatic, laxative, carminative, similar to belladonna, stramonium, and duboisia, but less powerful and irritating, yet the most calmative and hypnotic of the group, sedative to urinary tract. Hyoscyamine is less active than atropine; it is more an anodyne or anæsthetic than narcotic or soporific, depresses spinal but excites cerebral function. Hyoscine is much stronger than hyoscyamine, being a powerful cerebral and spinal sedative; lessens pulse and respiration; habitually used produces muscular paralysis, violent delirium.

**USES.**—Mostly with children, and where opium is contraindicated; acute and chronic mania, delusional insanity, insomnia with hallucinations, delirium tremens, monomania of hypochondriacs, whooping-cough, nervous cough, colics, tremor in paralysis, mercurial poisoning, locomotor ataxia, irritation of bladder, constipation, chorea, tetanus, morphine-habit, corrective to griping and nauseating medicine.

**Poisoning:** Same as for belladonna; but for hyoscine use chiefly hydrated chloral.

**Incompatibles, Synergists:** Same as those of belladonna.

**Hyoscyami Semen.**—Official 1830–1880. These are stronger than leaves, and used mostly for extraction of alkaloids; they are roundish, reniform, flattened. 1–1.5 Mm. ( $\frac{1}{8}$ – $\frac{1}{6}$ ') long, testa finely pitted, grayish-brown, sharp near the raised portion (dif. from stramonium seed), inodorous, taste oily, bitter, acrid. Dose, gr. 1–5 (.06–.3 Gm.).

**Allied Plants:**

1. *Hyoscyamus pal'lidus*.—Flowers are pale yellow and have no purple (*niger*) veins in the corolla. *H. agrestis* (of the field, wild); small annual, .3 M. (1°) high, less villous, with leaves smaller, and fewer flowers. *H. albus* and *H. aureus*, the former with white flowers, the latter with golden-yellow; both less active than the official.

2. *Duboisia myoporoides*.—Australia. Small tree having properties similar to those of belladonna and hyoscyamus; leaves 7.5–10 Cm. (3–4') long, 12–25 Mm. ( $\frac{1}{2}$ –1') broad, petiolate, midrib prominent, entire, taste bitter; contains duboisine 0.3–1 p. c., a volatile alkaloid

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(mixture of hyoscyamine, scopolamine, and atropine), which forms numerous salts. Dose of leaves, gr. 1–3 (.06–.2 Gm.), duboisine hydrobromide or sulphate, gr.  $\frac{1}{120}$ – $\frac{1}{60}$  (.0005–.001 Gm.); used externally for eye affections, in solution (1 p. c. in water).

**STRAMONIUM. STRAMONIUM.**

**Datura**  
**Stramonium, Linné.** } The dried leaves, containing 0.35 p. c. of mydriatic alkaloids.

*Habitat.* Asia; naturalized universally (Europe, England, N. America, etc.).

*Syn.* Stramonii Folia, U. S. P. 1890, Thorn-apple, Devil's or Mad Apple, Jamestown, Jimson, Jimson-, or Stink-weed, Stink-wort, Devil's Trumpet, Fire-weed, Jamestown Lily, Dewtry, Apple of Peru; Fr. Stramoine, Pomme Épineuse, Feuilles de Stramoine; Ger. Stechapfel, Dornapfel, Stechapfelblätter.

**Da-tu'ra.** L. alteration of Ar. name of the plant *tatorah*, or Hind. *dhatūra*; *tatula* is altered from *datula*, its name as given by Turks and Persians.

**Strā-mo'ni-um.** L. contr. of Gr. *στρίκνον μανικόν*, used by Dioscorides for this and for *Atropa Belladonna*.

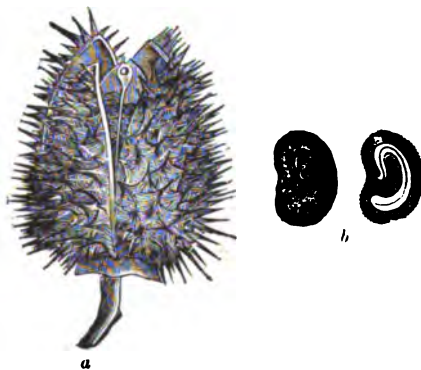
*Jimson-weed.* For Jamestown, Va., where first found growing on ship rubbish.

**PLANT.**—Coarse annual herb, bushy, rank odor, noxious, infesting fields, roadsides, waste places, near houses, never in mountains or woods, stem green, succulent, nearly solid 1–1.5 M. (3–5°) high, 2.5–4 Cm. (1–1½') thick, dividing into 2–3 branches above the ground; root tapering, white; flowers June–Sept., solitary calyx 5's, tubular, green, 4 Cm. (1½') long; corolla 5's, tubular or funnel-shaped, 7.5–10 Cm. (3–4') long, 5 Cm. (2') wide, white; fruit capsule 5 Cm. (2') long, ovate, obtusely quadrangular, covered with unequal, sharp, rigid spines, 4-celled, dehiscing

FIG. 356.

*Datura Stramonium*: flowering branch.

FIG. 357.

*Datura Stramonium*: a, fruit; b, stramonium seed and section, magnified 3 diam.

half-way down into 4 segments; ovary 2-carpelled, 2-celled; seeds numerous, brownish-black, angled, flattened, 4 Mm. (¼') long. **LEAVES**, 6–20 Cm. (2½–8') long, 7.5–15 Cm. (3–6') wide, petiolate, dark green

above, grayish-green underneath, much wrinkled and matted together, inequilaterally ovate, acuminate, very oblique at base, the large teeth few, acute with rounded sinuses, thin, brittle; odor distinct, heavy, narcotic; taste nauseous; powder contains few hairs, many rosette-shaped calcium oxalate crystals. *Solvents*: alcohol (75 p. c.) or diluted alcohol; hot water partially. Dose, gr. 1–5 (.06–.3 Gm.).

**ADULTERATIONS.**—Leaves of allied species (usually smaller), French cultivated, and *Xanthium strumarium*.

**Commercial.**—Plant was possibly unknown to the ancients; was described by Gerarde in sixteenth century, and introduced into medicine by Störek in 1672. Gypsies brought leaves and seeds from Asia into Europe in the middle ages, using the smoke therefrom to intoxicate their dupes. All parts are medicinal, and the plant grows well with us, especially in Michigan and other western States. Leaves should be gathered during flowering, by pulling up entire plant, then quickly removing and drying them, when they are frequently broken or cut into pieces.

**CONSTITUENTS.**—Daturine 0.2–0.4 p. c., mucilage, albumin, potassium nitrate, ash 17 p. c.

**Daturine.**—An alkaloid combined with malic (daturic) acid, and consists of hyoscyamine and atropine, the former usually predominating, and probably little hyoscine, forms salts (hydrochloride, sulphate, etc.). Dose, gr.  $\frac{1}{20}$ – $\frac{1}{50}$  (.0005–.001 Gm.). The oil contains daturic acid,  $C_{17}H_{34}O_2$ .

**Assay**: Identical with that of belladonna leaves, page 542, using stramonium 10 Gm.

**PREPARATIONS.**—1. *Fluidextractum Stramonii*. Fluidextract of Stramonium. (Syn., Extractum Stramonii Fluidum; Fr. Extrait liquide des Feuilles de Stramoine; Ger. Flüssiges Stechapfelblätter-extrakt.)

**Manufacture**: Macerate, percolate 100 Gm. with alcohol 65 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 0.35 Gm. of mydriatic alkaloids. **Assay**: Identical with that of fluidextract of belladonna root. Dose,  $\mathfrak{m}$ j–5 (.06–.3 Cc.).

**Prep.**: 1. *Extractum Stramonii*. Extract of Stramonium. (Syn., Fr. Extrait de Feuilles de Stramoine; Ger. Stechapfelblätter-extrakt.)

**Manufacture**: Evaporate cautiously to a pilular consistence fluid-extract of stramonium 100 Cc.; when assayed should contain 1.4 p. c. of mydriatic alkaloids, and any excess of strength must be reduced with sufficient sugar of milk. **Assay**: Identical with that of extract of belladonna. Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.01–.03 Gm.).

**Prep.**: 1. *Unguentum Stramonii*. Stramonium Ointment. (Syn., Fr. Pommade de Stramoine; Ger. Stechapfelsalbe.)

**Manufacture**: 10 p. c. Triturate extract of stramonium 10 Gm. with diluted alcohol 5 until homogeneous, incorporate hydrous wool-fat 20, add benzoinated lard 65, mix thoroughly.



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2. *Tinctura Stramonii*. Tincture of Stramonium. (Syn., Br. *Tinctura Stramonii*, Tincture of Stramonium ; Fr. *Teinture de Stramoine* ; Ger. *Stechapfeltinktur*.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with diluted alcohol q. s. 100 Cc. Dose, m.v-30 (.3-2 Cc.).

*Unoff. Preps.*: LEAVES: *Succus*. *Plaster*. *Cigarettes*. ROOT: *Plaster*. *Fomentation*.

**PROPERTIES**.—Narcotic, anodyne, antispasmodic, diuretic, mydriatic. Internally very similar but stronger than belladonna ; weaker externally. Large doses produce dry throat, cardiac irregularity, high fever with delirium, increase sexual desire, possibly laughing and hallucinations (like in cholera, alcoholism), dizziness, fainting, red eruptions, dilated pupils, insomnia, black objects appear green ; pneumogastric becomes paralyzed, thus stopping the inhibitory action, hence whole system paralyzed finally by over-stimulation, including the heart, then delirium, stupor, convulsions, death by asphyxia ; in case of recovery remember nothing that has occurred ; does not affect some animals, as caterpillar tribe, goats, etc.

**USES**.—Insanity, mania, melancholia, epilepsy, nervous asthma (gr. 15 (1 Gm.) of leaves smoked with tobacco or sage at each paroxysm), whooping-cough, dysmenorrhœa, retention of urine, hepatic colic, laryngeal cough, chorea. Ointment in ulcers, hemorrhoids, fissures, skin diseases, poison-oak eruptions, rheumatism, bruises, sprains. In the absence of belladonna may use stramonium with good results.

*Poisoning, Incompatibles, Synergists*: Same as for belladonna.

*Allied Plants*:

1. *Datura Tat'ula*, *Purple Thorn-apple*.—Considered by some the same as *D. Stramonium*, but has purple stems, petioles and corolla. *D. fastuosa* (*alba*), India—used here as a criminal poison ; capsule small, subglobular, spinous, seeds yellowish-brown, triangular, rough. *D. Met'el*, *Entire-leaved Thorn-apple*, Africa, S. Asia ; capsule and seeds like *D. fastuosa* (*alba*), leaves nearly entire, downy. *D. sanguinea*, Peru ; large shrub, or tree, leaves nearly entire, downy beneath, flowers large, upper half of corolla yellow, lower half blood-red.

2. *Fabia'na imbricata*, *Pichi*.—Peru, Chile. Plant 1.5-2 M. (5-6°) high, growing on rocky hill-tops, resembling the pines somewhat ; the woody branches are used, being resinous, with aromatic odor and taste ; contain fabianine, resin, volatile oil. Diuretic, tonic, cholagogue ; chronic vesical catarrh, gravel, renal, urethral, or cystic calculi. Should not be used in organic disease. Dose, gr. 5-40 (.3-2.6 Gm.).

3. *Nicotia'na Tabac'um*, *Tabacum*, *Tobacco*.—The commercial dried leaves, official 1820-1900 ; C. and S. America (cultivated). Coarse robust annual, 1-2 M. (3-6°) high ; stem erect, unbranched, solid, green, hairy ; root long, fibrous ; flower rose-colored, calyx bell-shaped, hairy, viscid, corolla 4-5 Cm. (1½-2') long, tubular, inflated ; fruit ovate capsule, 2.5 Cm. (1') long, opening at summit ; seeds many, reniform, reticulate, brownish. Leaves, about .5 M. (20') long, 10-15 Cm. (4-6') wide, ovate-lanceolate, acute, entire, waved, brown, friable,



hairy; odor heavy, peculiar; taste nauseous, bitter, acrid. Plant not known to be wild, and leaves in curing undergo a sweating process

FIG. 358.

*Nicotiana Tabacum.*

(chemical change) by which odor is modified through generation of a new volatile principle, and amount of nicotine decreases owing to its volatility; contains nicotine 0.7–5–11 p. c. (colorless oily liquid), nicotine 2 p. c., nicotelline, nornicotine, resin, gum, malates, citrates, ash 14–18–27 p. c. (Ca, K,  $\text{NH}_4$ —phosphates, chlorides, nitrates); solvents: alcohol, hot water. Narcotic, sedative, diuretic, emetic, diaphoretic, cathartic, antiseptic; first stimulates (causing convulsions) then paralyzes motor nervous system (spine), produces vomiting, purging, collapse, contracted pupils, depressed then increased heart action (rapid, feeble pulse), cold extremities, death by paralysis of respiration and heart; excessive use causes dyspepsia, diminished sexual power, nervousness, angina pectoris, and in the young impairs body nutrition. So severe as to be little employed as a medicine, but may be used to relax spasms, relieve local pain, constipation, spasmodic asthma, tetanus, as an enema in intussus-

ception, strangulated hernia, impacted cæcum, hemorrhoids, scabies, strychnine-poisoning. *Poisoning*: By tobacco or nicotine, give tannin, emetics, then strychnine (physiological antidote), alcohol, ammonia, digitalis, belladonna, iodides, artificial respiration, maintain recumbent position. Dose, gr.  $\frac{1}{2}$ –3 (.03–.2 Gm.); wine (vinum), 10 p. c., Mv–60 (.3–4 Cc.); enema tabaci, 5 p. c.; oleum tabaci (from distilling leaves—acrid, poisonous, dark brown oily liquid); aqueous extract, fluidextract, infusion, ointment, poultice.

4. *N. rus'tica*, Wild Tobacco, and *N. quadrival'vis*, Canada, Eastern U. S. *N. repa'nda*, Cuba. *N. per'sica*, Persia. *N. rustica*, cultivated in Turkey, India, etc. All may be used similarly.

### 73. SCROPHULARIACEÆ. Figwort Family.

Skrof-u-la-ri-a'se-e. L. *Scrophulari-a* + *aceæ*—i. e., from its efficacy in scrofula. Herbs, rarely shrubs. Distinguished by stamens 2–4–5, didynamous or 2 perfect, inserted on 2-lipped corolla-tube; flowers irregular, 4–5's, 2-lipped; ovary 2-celled, central placenta, superior, style 1; seeds many in fleshy albumin; fruit, capsule or berry; universal; bitter, astringent, emetic, purgative, diuretic, narcotic, poisonous, often cultivated for beautiful flowers.

Genera: 1. *Veronica*. 2. *Digitalis*.

## SCROPHULARIACEÆ.

## LEPTANDRA. LEPTANDRA.

*Veronica*  
*virginica*, Linné. } The dried rhizome and roots.

*Habitat.* N. America (Canada to Georgia to Minnesota; in low grounds).

*Syn.* Culver's Root, Culver's Physic, Bowman's, Beaumont, Brinton, Physic or Black-root, Oxadoddy, Purple Leptandra, Tall Speedwell or Veronica, Whorlywort, Hini, Quital; Fr. Racine (de Leptandra) de Véronique de Virginie; Ger. Leptandra-wurzel.

*Lep-tan'dra.* L. fr. Gr. λεπτός, thin, slender, + ανδρός, stamen—i. e., its two slender stamens.

*Ve-ron'i-ca.* L. fr. Gr. φέρειν, to bear, + νικη, victory, or L. vera, + Gr. εικών, image—i. e., flower of St. Veronica, which was thought to resemble Christ's face.

*Vir-gin'i-ca.* L. Virginian—i. e., formerly its southern limit of growth.

**PLANT.**—Perennial herb; stem .6–2 M. (2–6°) high, angular, smooth or downy; leaves 7.5–10 Cm. (3–4') long, in whorls of 4–7, lanceolate, pointed, serrate; flowers July–Aug., small, whitish, tubular, stamens 2, much exserted, spikes 15–30 Cm. (6–12') long; fruit small, oblong, compressed capsule, opening by 4 teeth, 2-celled, many-seeded. **RHIZOME**, of horizontal or oblique growth, 4–15 Cm. (1½–6') long, 3–8 Mm. (⅓–⅓') thick, somewhat bent and branched, gray-brown to blackish-brown, cup-shaped scars on upper side, annulate, the inferior and lateral surfaces with coarse roots and root-scars, fracture tough, woody, branches readily separable from main rhizome, internally bark dark brown, 0.3–1 Mm. (⅓–⅓') thick, wood hard, yellowish, pith large, purplish-brown, roots slender, longitudinally wrinkled, fragile; odor slight; taste bitter, slightly acid. *Solvents*: alcohol (75 p. c.) or water. Dose, gr. 15–60 (1–4 Gm.).

*Commercial.*—Dr. Culver, after whom the root is named, used it extensively in his practice, so that it was one of our early popular American drugs; it prefers mountain valleys, meadows, rich woodlands, and often is cultivated in gardens for its beautiful flowers, which vary from white, flesh to purple color.

**CONSTITUENTS.**—Leptandrin, resin (inert?) 6 p. c., saponin, tannin, mannite, gum, citric acid, possibly a volatile alkaloid.

**Leptandrin.**—Glucoside obtained by precipitating infusion with lead subacetate, filtering, removing excess of lead with sodium carbonate, passing filtrate through animal charcoal-column to absorb active constituents, washing charcoal with water until bitterness is attained; then treating with boiling alcohol, evaporating. To purify, dissolve in ether, evaporate, getting needle-shaped crystals, which are bitter, soluble in water, alcohol, ether, not precipitated by lead subacetate. The "Eclectic" resinoid, *leptandrin*, made by precipitating concentrated alcoholic tincture with water, owes its virtues to the accidental presence of true leptandrin, as the resin is considered inert; it is approximately an alcoholic extract; the mother-liquor contains mannite along with considerable active constituent. Dose, gr. 1–5 (.06–.3 Gm.).

FIG. 359.



*Veronica virginica*: transverse sections of rhizome and root.

PREPARATIONS.—1. *Fluidextractum Leptandræ*. Fluidextract of Leptandra. (Syn., *Extractum Leptandræ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Leptandra*; Ger. *Flüssiges Leptandraextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv–60 (1–4 Cc.).

Prep.: 1. *Extractum Leptandræ*. Extract of Leptandra. (Syn., Fr. *Extrait de Leptandra*; Ger. *Leptandra(wurzel)-extrakt*.)

*Manufacture*: Evaporate cautiously to dryness fluidextract of leptandra 100 Cc., reduce to powder, add powdered glycyrrhiza (peeled Russian) q. s. 25 Gm., mix thoroughly. Dose, gr. 1–5 (.06–.3 Gm.).

Prep.: 1. *Pilulæ Catharticæ Vegetabiles*, extract of leptandra  $\frac{1}{4}$  gr. (.016 Gm.).

*Unoff. Prep.*: *Tincture*, 10 p. c. (alcohol), dose, ʒj–2 (4–8 Cc.).

PROPERTIES.—Emeto-cathartic, cholagogue, alterative, tonic.

USES.—Duodenal atony, chronic constipation with insufficiency of biliary and intestinal secretions. Leptandrin resembles podophyllin closely in action. Fresh root acts violently on some persons; it is not believed to affect the liver to any appreciable extent.

FIG. 360.



*Veronica officinalis*: flowering branch.

#### Allied Plants:

1. *Veronica officinalis*, *Common Speedwell*.—N. America. Procreant, pubescent, perennial, stem ascending, 7.5–25 Cm. (3–10') high; leaves obovate, petioled, 2–4 Cm. ( $\frac{4}{5}$ –1  $\frac{3}{5}$ ') long, serrate, grayish-green; flowers axillary racemes, wheel-shaped, 4-parted, pale blue corolla with dark blue stripes, 2 exserted stamens; contains bitter principle, tannin; plant used as alterative, diuretic (urinary, calculous disorders), diaphoretic, expectorant, (skin diseases, scurvy); in infusion. Dose, gr. 30–60 (2–4 Gm.).

2. *Scrophularia nodosa*, *Figwort*.—N. America. Perennial plant growing in damp places, 1.2–1.5 M. (4–5°) high, stem obtusely angled, rhizome fleshy, having attached many oval tubers size of the thumb, leaves opposite, serrate; plants bruised when fresh emits an unpleasant, fetid odor; contains scrophularin, scrophularosmin, resin, tannin; alterative, diuretic, anodyne in hepatic affections, scrofula, dropsy, eczema, itch, hemorrhoids, anal ulcers, suppurating sores, etc. Dose, gr. 30–60 (2–4 Gm.).

3. *Chelone glabra*, *Balmoney*, *Snake-head*.—United States. Perennial plant growing in damp places, .6–1 M. (2–3°) high; leaves opposite, oblong-lanceolate, serrate, 7.5–15 Cm. (3–6') long, flowers white, faintly pink, 2.5 Cm. (1') long, short, dense, terminal spike; contains

## SCROPHULARIACEÆ.

bitter principle; tonic, laxative, anthelmintic, jaundice, liver trouble; skin diseases (eczema, etc.) externally. Dose, gr. 30–120 (2–8 Gm.), in decoction.

## DIGITALIS. DIGITALIS.

**Digitalis purpurea**, Linné. { The dried leaves, collected from plants of the second year's growth, at the commencement of flowering.

*Habitat.* W. and C. Europe; sandy soil, edges of woods, thickets.

*Syn.* Foxglove, Fairy Gloves, Folks' or Ladies' Glove, Dog's Finger, Fairy Fingers, Dead Men's Bells, Finger Flower, Purple or American Foxglove, Thimbles, Fairy Cup, Lion's Mouth, Scotch Mercury, Throatwort, Rabbit's Flower; Br. *Digitalis Folia*; Fr. Feuilles de Digitale pourprée (de grande Digitale), Doigtier; Ger. Fingerhutblätter.

**Dig-i-ta-lis.** L. pertaining to the fingers, fr. *digitus*, a finger—i. e., the finger-shaped corolla, named by Fuchs, 1542, after Ger. *fingerhut*, a thimble.

**Pur-pu-re-a.** L. *purpureus*, purple-colored—i. e., its purple flowers.

*Foxglove.* Corruption of *Folks' glove*, *Folk*, synonym of *Fairies*.

**PLANT.**—Biennial herb, cultivated for ornament and medicine; stem .6–1.5 M. (2–5°) high, succulent, downy, leafy; flowers July–Aug., tubular, bell-shaped, 5-lobed, outside purple, inside sprinkled with black spots upon a white ground, mouth hairy, terminal racemes; one variety has white flowers; seeds small, numerous, brownish-gray in a 2-celled pyramidal capsule. **LEAVES**, 10–30 Cm. (4–12') long, 5–15 Cm. (2–6') broad, ovate, abruptly contracted into a winged petiole 5–10 Cm. (2–4') long, dull green, grayish underneath, wrinkled, sparsely hairy above, densely and finely hairy below with venation conspicuously reticulated, crenate or erose-dentate, midrib and principal veins broad and flat, as a rule purplish, lower veins continued into wings of the petiole; usually in more or less crumpled, broken fragments; odor slight, characteristic; taste strongly bitter, nauseous; leaves smaller at nearing the summit, those of cultivation being less hairy and active; powder contains no stone-cells, star-shaped hairs, or calcium oxalate crystals. *Solvents*: alcohol (65 p. c.); boiling water partially. Dose, gr. 1–2 (.06–.13 Gm.).

**ADULTERATIONS.**—**LEAVES**: First year's leaves; also leaves of *D. ambigua* (*ochroleuca*)—nearly smooth; *Verbascum Thapsus*—lighter-colored, entire, densely long-tomentose, mucilaginous; *Symphytum officinale*—entire, scabrous; *Conyza* (*Inula squarrosa*)—scabrous, entire; **POWDER**: Pale green and distinguished from all adulterations by the 3–5-celled hairs and absence of calcium oxalate crystals.



*Digitalis purpurea.*

*Commercial.*—The leaves lose on drying 75 p. c. in weight, and should be collected from wild plants growing in mountainous regions when two-thirds of the flowers are expanded; this latter is essential from the fact that there are two series of compounds formed by the action of light and air in plants: first, *nutritious*, those for nutrition

FIG. 362.



*Digitalis purpurea*: a, single flower; b, the same opened.

(constructive metabolism); second, *secretious*, or secretions of waste products (destructive metabolism). During the flowering stage every nutritive avenue and substance is taxed and used for flower perfection, thus leaving elsewhere, as in leaves, etc., the waste products, alkaloids, etc., in a most concentrated form; for the same reason bella-

FIG. 363.



*Digitalis* leaves, upper surface: a, of the first year's growth; b, of the second year's growth.

donna, hyoscyamus, and many other plants should have leaves (and other official parts) gathered only when in bloom, which for digitalis, hyoscyamus, and belladonna is the second year of growth, hence the second crop of leaves. Only those full grown and fresh are gathered, then carefully and quickly dried without exposure to sun or undue heat, and protected from external moisture, each being separate, or in

**SCROPHULARIACEÆ.**

baskets placed in dark drying stoves, or the entire plant may be hung up by the roots in a current of warm air, such yielding most digitoxin, that by which the drug's value is determined; carelessness in this process often renders the product inert. When dry should be kept in air-tight, dark containers, and not longer than one year if exposed to light and moisture, their qualities depending upon color, smell, taste, and yield of digitoxin. Seeds are much stronger, keep better, and do not deteriorate upon drying.

**CONSTITUENTS.**—Digitalin, digitoflavon, resin, digitalosmin (stear-opten), volatile oil, fixed oil 5 p. c., starch, sugar, gum, antirrhnic acid, digitalic (malic) acid, inosite, pectin, ash 10 p. c.

**Digitalin (Digitalinum).**—A glucoside extracted by digesting leaves 1 part in alcohol 3, at 49° C. (120° F.), for 24 hours; percolate with alcohol until exhausted, reclaim alcohol, mix residue with acidified (acetic acid) water and charcoal, digest, filter, dilute filtrate, neutralize with ammonia, precipitate with tannin, wash precipitate, rub down with alcohol and lead oxide, boil with alcohol an hour, add charcoal, filter, evaporate, wash residue with ether. It is a yellowish powder, or scales, soluble in alcohol, insoluble in water, and thus constitutes the French amorphous and crystalline varieties, the latter consisting almost entirely of digitoxin. Our commercial digitalin, however, is the German, and, although chiefly digitonin, is largely soluble in water, being possibly a mixture of 6 compounds: 1. *Digitalin*,  $C_{35}H_{56}O_{14}$ , heart stimulant glucoside, crystalline, soluble in alcohol, sparingly in water, increased by presence of digitonin; alcoholic solution heated with diluted hydrochloric acid yields digitaligenin, glucose, digitalose. 2. *Digitoxin*,  $C_{34}H_{54}O_{11}$ , 0.2–0.4 p. c., white, bitter, crystalline, most active principle, heart stimulant, soluble in alcohol, chloroform, insoluble in water, nearly so in ether, deposited as a sediment from alcoholic preparations of leaves, by acids converted into digitoxigenin, digitoxose. 3. *Digitophyllin*,  $C_{32}H_{52}O_{10}$ , glucoside, heart stimulant, hydrolized with difficulty, not very soluble, being probably methyl-digitoxin. 4. *Digitonin*,  $C_{54}H_{92}O_{23}$ , the preponderating and once supposed diuretic principle; it is a heart depressant (muscle and nerve), glucoside, white powder resem-

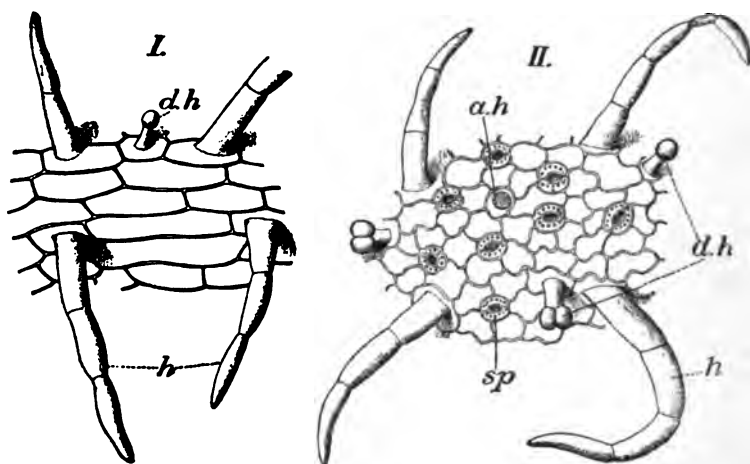
FIG. 364.



Digitalis leaf: under surface.

bling saponin, soluble in diluted alcohol, slowly in water, solutions frothing when shaken, insoluble in ether, sparingly in chloroform, crystallizes from alcohol, red with sulphuric acid, heated with diluted acid splits into dextrose, galactose, and digitogenin; claimed to cause the gelatinization of fluid preparations of digitalis, playing a very important part in those where water is the menstruum. 5. *Digitalein*, heart stimulant glucoside, amorphous yellowish-white powder, soluble in

FIG. 365.



*Digitalis* leaf: I., epidermis of upper side seen from above with velvet hairs (*h*) and glandular hairs (*d.h*); II., epidermis of under side with stomata (*sp*), velvet hairs (*h*), glandular hairs (*d.h*), and the scar of a broken hair (*a.h*), magnified 175 diam.

alcohol, ether, water, not yet chemically well characterized, considered by some digitonin with traces of digitoxin and digitalin. 6. *Digitin*, believed by many to be digitonin, possibly inert. Owing to varying composition of digitalin uniform doses become impossible; usual dose, gr.  $\frac{1}{80}$ – $\frac{1}{30}$  (.001–.002 Gm.); if in crystals, it consists largely of digitoxin and digitonin. Dose, gr.  $\frac{1}{200}$ – $\frac{1}{100}$  (.0003–.0006 Gm.).

**Digitoflavin**,  $C_{15}H_{10}O_6$ .—This is dissolved out along with digitoxin when the extract is shaken with ether. It is not a glucoside, but a phenol (quercetin series), and occurs in yellow crystals, soluble in alcohol.

**PREPARATIONS.**—1. *Fluidextractum Digitalis*. Fluidextract of Digitalis. (Syn., Extractum Digitalis Fluidum, U. S. P. 1890; Fr. Extrait liquide de Digitale; Ger. Flüssiges Fingerhutextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, Mj–2 (.06–.13 Cc.).

**Prep.:** 1. *Extractum Digitalis*. Extract of Digitalis. (Syn., Extractum Digitalis Alcoholicum; Fr. Extrait Alcoolique de Digitale; Ger. Fingerhutextrakt.)

**Manufacture:** Evaporate cautiously to pilular consistence fluidextract of digitalis 100 Cc. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.01–.03 Gm.).

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2. *Infusum Digitalis*. Infusion of Digitalis. (Syn., Fr. Tisane de Digitale; Ger. Fingerhutaufguss.)

*Manufacture*: 1.5 p. c. Macerate 1 hour 1.5 Gm. with boiling water 50 Cc., strain, add alcohol 10, cinnamon water 15, cold water q. s. 100 Cc. Dose, ʒij–4 (8–15 Cc.).

3. *Tinctura Digitalis*. Tincture of Digitalis. (Syn., Fr. Teinture de Digitale; Ger. Fingerhuttinktur.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with diluted alcohol q. s. 100 Cc. Dose, ℥v–30 (.3–2 Cc.).

*Unoff. Prep.*: *Abstract*, dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.).

While the infusion is the best diuretic, the tincture is the best for heart action. This latter and the fluidextract, owing to alcohol present, contain most digitalin and digitalein, with very little digitonin—the digitoxin being precipitated. The extract has also digitoxin, while infusion mostly digitonin, little digitalein, no digitoxin or digitalin.

**PROPERTIES.**—Cardiac tonic, vascular stimulant, diuretic, motor-excitant, paralyzant, anaphrodisiac, sedative, narcotic, emetic; normal doses make the pulse slower, firmer, stronger. The diastole (periodic dilatation) is prolonged, owing to stimulation of the pneumogastric; the systole (periodic contraction) is not altered as to duration, but is in degree, the force being greatly increased, owing to stimulation of the heart muscle and its contained ganglia, which may be so powerful as to squeeze out all of the blood, thus causing death in systole by over-stimulation. Temperature is lowered by the lessening of blood supply to the tissues. Blood-pressure in the glomeruli of the kidneys is increased, causing diuresis. Recumbent position is best when under its influence. The rapid pulse is due to over-stimulation of the pneumogastric (inhibition) and consequent exhaustion, thus allowing the sympathetic alone to control the action. Digitalis and aconite slow the heart, otherwise are antagonistic; the former increases inhibition, stimulates motor apparatus; the latter does the converse, thus weakening the beat, both finally paralyze cardiac ganglia—digitalis by over-stimulation, aconite by direct depression. Arterial tension is raised by digitalis, lowered by aconite; the latter acts quickly, the former slowly, possessing cumulative action—*i. e.*, several doses given at proper intervals may show no result until suddenly the combined action of all the doses is manifested at once, proving sometimes fatal if not very cautious. In consequence of this, aconite becomes a more valuable antagonist in digitalis-poisoning than digitalis in aconite-poisoning.

**USES.**—Where heart is rapid and feeble, renal disease, venous engorgement, dropsy, pneumonia, scarlet fever, congestive headache, hemicrania in mania, delirium tremens, hemorrhages, menorrhagia, rheumatic fever, spermatorrhœa, pleurisy, pericarditis, chronic bronchitis, epilepsy. Locally to enlarged glands, abdominal and renal dropsy.

**Poisoning:** Have sneezing, nausea, vomiting of mucus, bile, and dark green matter, colic, purging with severe pain, headache; heart beats violently, but pulse small and shallow, yet upon rising rapid, weak,



and irregular; vertigo, yellow vision, face pale, pupils usually dilated, sometimes contracted, eyeballs protruding, sclerotic blue colored, pain in back and limbs, diarrhœa, suppressed urine, salivation, conscious until near the end, delirium, coma, convulsions, death suddenly by paralysis of heart muscle. Wash out stomach with warm water and tannin, give diffusible stimulants (injections), aconitine (best to antagonize large quantities of digitalis), opium (best to antagonize long usage of digitalis), saponin, senegin (best physiological antagonist), Epsom or Rochelle salt, fluidextract of quillaja, and senega, external heat, horizontal position.

*Incompatibles*: Cinchona, tannin, iron sulphate, lead acetate, tincture of ferric chloride, syrupy and watery solutions, which may decompose drug's active principles.

*Synergists*: Cardiac stimulants, belladonna, ergot, etc.

*Allied Plants*:

1. *Verbascum Thapsus*, Mullen.—Europe, but naturalized in N. America. Flowers and leaves used. Plant .3–1.3 M. (1–4°) high, woolly, growing in fields, waste places; flowers yellow, 2.5–4 Cm.

FIG. 366.

*Verbascum Thapsus.*

FIG. 367.

*Sesamum indicum* a, flowering branch.  
b, section of seed enlarged.

(1–1½') broad; odor honey-like; taste mucilaginous, sweet; contains volatile oil, mucilage, sugar. Used as a demulcent, pectoral, apodyne, nutritive in consumption, coughs; in infusion. Dose, gr. 15–60 (1–4 Gm.). Dried leaves smoked for nasal catarrh.

2. *Sesamum indicum*, *Sesamum*, *Benne*.—A fixed oil expressed from the seed (oleum sesami, oil of sesamum, -teel, -benne), official 1820–1900; yield 47–56 p. c.; India, Africa, China, cultivated. Annual herb, 1–1.3 M. (3–4°) high, branched, quadrangular, striate, hairy; leaves lanceolate-ovate, petiolate, pubescent; flowers tubular, campanulate, 4 Cm. (1½') long, pale purple; fruit, capsule 2.5–5 Cm. (1–2')

## RUBIACEÆ.

long, narrowly oblong, olive-green, yellowish interior; seeds 5 Mm. ( $\frac{1}{8}$ ') long, rounded, triangular, flattened, yellowish. Oil, yellowish, inodorous, non-drying, taste bland, nut-like, sp. gr. 0.920; thickens at  $-5^{\circ}$  C. ( $23^{\circ}$  F.) into a yellowish-white mass; contains olein 76 p. c., myristin, palmitin, stearin, resinoid compound, higher alcohol, sesamin, and uncrystallizable oil (thick, non-nitrogenous, causing the oil to give cherry-red with hydrochloric acid and sugar). Laxative, demulcent, emollient, nutritious. Used like olive oil, but less agreeable and digestible. Dose,  $\text{ʒss}$ –2 (15–60 Cc.). Leaves (official 1830–1880) abound in gum or mucilage, being extracted by cold water, thus forming a demulcent drink for diarrhœa, dysentery, acute cystitis, etc.; seeds are used often by the Southern negroes, as by the natives in India, Africa, etc., for food (puddings and bread), poultice, abortive and emmenagogue (infusion).

3. *Ground-nut Oil*, *Pea-nut Oil* (*Ar'achis hypogæ'a*).—Tropical America; seeds contain fixed oil 45 p. c.; used instead of olive oil. *Soy Oil* (*Glyc'ine* (*So'ja*) *his'pida*), Japan; seeds reniform, used as food and for making a sauce (soy); contain bland fixed oil 15–20 p. c. *Ben Oil*, *Behen Oil* (*Morin'ga ap'tera*, *M. pterygosper'ma*), E. India; seeds called *ben-nuts*, have elongated, membranous wings; yield fixed oil 30 p. c.; used as purgative and in extracting perfume from flowers.

## 74. RUBIACEÆ. Madder Family.

Ru-bi-a'se-e. L. *Rubi-a* + aceæ, madder, fr. *rubeus*, *rubere*, red—i. e., referring to color of the roots. Trees, shrubs, herbs. Distinguished by versatility of important uses; stems round or angular; leaves opposite, stipulate, calyx 4–5-toothed, superior; corolla 4–5, regular, epigynous; stamens 4–5, on corolla-tube, anthers 2-celled; ovary inferior, 2–4-celled; fruit inferior, dry or succulent, edible, 2-celled; seeds 1 or more in each cell; temperate climates, tropics; tonic, febrifuge, astringent, emetic, purgative, diuretic, emmenagogue, dyeing, tanning, poisonous.

Genera: 1. *Coffea*. 2. *Cephaelis*. 3. *Cinchona*.

## CAFFEA. COFFEE.

Caffeina. Caffeine,  $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 + \text{H}_2\text{O}$ , official.

<p><i>Coffea arabica</i>, Linné, and <i>Thea chinensis</i>, Linné.</p>	{	<p>A feeble basic substance (alkaloid) from the dried seeds of the former and dried leaves of the latter (Theaceæ), also from other plants. See page 419.</p>
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*Habitat.* 1. Tropical Africa (Arabia, Abyssinia, Ceylon, Mocha); cultivated in tropical countries (Java, W. Indies, S. America—Brazil, etc.). 2. S. E. Asia (upper Assam, China, Japan, Java, S. United States); cultivated.

*Syn.* Semen Coffea; Fr. Café; Ger. Kaffee (bohnen), Caffea; Theine, Guaranine, Trimethylxanthine, Methyltheobromine; Fr. Caféine, Théine; Ger. Coffeinum, Koffein, Kaffein, Thein.

*Coffe-a.* L. for coffee, after Coffee, a province of Narea, in Africa, where it grows abundantly; Arabic name of the decoction—*chaubé*, *cavé*, *cahua*, *caova*.

*A-rab'i-ca.* L. Arabian—i. e., its chief habitat.

**PLANT.**—Shrub or small tree 3–4.5 M. (10–15°) high, by cultivation trimmed down to 1.5–2 M. (5–6°); bark smooth, gray; leaves 10–15 Cm. (4–6') long, 2.5–5 Cm. (1–2') wide, oval, entire; flowers small, fragrant, white, funnel-shaped, cymes; fruit oblong, ovoid, 12 Mm. ( $\frac{1}{2}$ ') long, scarlet, but purple when ripe, 2-celled, 2-seeded, pericarp with scanty pulp, endocarp thin, dry; seeds large, solitary in each cell, rounded back, flat on ventral surface (by which they face each other), having in the centre a deep narrow fissure, hard, bony, grayish.

**ADULTERATIONS.**—**SEED:** Inferior grades—natural discolored—yellow and brown grain—artificial colored with Prussian blue, indigo, sugar, egg-albumin, (removed by soaking in water); factitious coffee

FIG. 368.



*Coffea arabica*: A, blooming and fruiting twig; B, fruit; C, fruit, cross-section; D, fruit, longitudinal section; E, seed still partly enclosed in the parchment-like endocarp.

made up of clay, kaolin, evaporated skimmed milk, etc.; these have little taste and no groove on flat side. **GROUND COFFEE:** Sometimes roasted dandelion, chicory, amylaceous roots, corn, peas, beans, acorns, wheat, rye, sweet potatoes, coffee extract, etc.

**CONSTITUENTS.**—Caffeine 1–2.3 p. c., fat (olein, palmitin) 13 p. c., glucose, dextrin 15 p. c., proteids 13 p. c., caffeeo-tannic acid, volatile oil, ash 3–5 p. c.

**Caffeina. Caffeine.**—This is prepared commercially almost exclu-

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sively from tea and tea-dust or sweepings, but can be obtained from a strong infusion of tea or unroasted coffee by adding lead acetate to precipitate tannin, coloring matter, etc., filtering, removing excess of lead by hydrogen sulphide, concentrating, crystallizing. It is in white, flexible, silky, glistening needle-shaped crystals, usually matted together in fleecy masses, permanent, odorless, bitter, soluble in 45.6 parts water, 53.2 alcohol, 375 ether, 8 chloroform, solubility in water increased by potassium bromide, sodium benzoate and salicylate, etc.; sublimes at 178° C. (352° F.) without residue; boiling with barium or potassium hydroxide converts it into CO<sub>2</sub> and caffeidine, C<sub>7</sub>H<sub>12</sub>N<sub>4</sub>O, this latter going into sarkosine, formic acid, methylamine, and ammonia; forms numerous salts (citrate, nitrate, phosphate, etc.). *Tests*: 1. Sulphuric acid solution + fragment of potassium dichromate gives yellowish then green liquid. 2. Aqueous solution should not be precipitated by mercuric potassium iodide T. S. (abs. of other alkaloids). Dose, gr. 1–5 (.06–.3 Gm.).

*Commercial*.—Coffee tree resembles our cherry, grows in clusters in hilly woods, 300–600 M. (1,000–2,000°) elevation. Was first known in Europe (1652) as being from Arabia and Abyssinia, where it was popular in the fifteenth century. The Dutch first grew it in Europe, 1690, and introduced it into America at Surinam, 1718, Cayenne, W. Indies, 1725. Have several varieties: 1. *Mocha*; best and smallest, growing on the Arabian hills around Mocha, dark yellow. 2. *Java*, *E. Indian*, *Ceylon*; largest grained, pale yellow. 3. *Rio*, *Brazilian*, *W. Indian*, *Demarara*; intermediate size, bluish or greenish-gray. 4. *Liberian* (*C. liberica*); has larger berries, finer flavor. The seeds are separated from papery endocarp by drying, passing between wooden rollers, and through a winnowing mill. In roasting at 250° C. (482° F.), the fat, sugar, and tannin are destroyed, some caffeine volatilized, and empyreumatic volatile oil (coffeol, coffeone) or some other active principle, volatile or otherwise, is produced—losing 8 p. c. water and 9 p. c. organic matter. Much care should be exercised in this process to use closed vessels and not too great heat.

**PREPARATIONS**.—1. *Caffeina Citrata*. Citrated Caffeine. (Syn., Br. Caffeine Citras, Caffeine Citrate; Fr. Citrate de Cafféine; Ger. Koffeincitrat.)

*Manufacture*: Dissolve citric acid 50 Gm. in hot distilled water 100 Cc., add caffeine 50 Gm., evaporate on water-bath to dryness, constantly stirring towards the finish, reduce to powder. It is a white powder, odorless, bitter, acrid taste, acid reaction; forms clear syrupy solution with 4 parts hot water, which precipitates with 5 parts water, but redissolves upon addition of 25 parts; soluble in mixture of equal volumes of chloroform and alcohol. *Impurities*: Tartaric acid, etc. Should be kept in well-stoppered bottles. Dose, gr. 2–10 (.13–.6 Gm.).

*Prep.*: 1. *Caffeina Citrata Effervescens*. Effervescent Citrated Caffeine. (Syn., Br. Caffeine Citras Effervescens, Effervescent Caffeine Citrate; Ger. Brausendes Koffeincitrat.)

*Manufacture*: Mix powdered citric acid 19.5 Gm. with citrated

caffeine 4 and tartaric acid 30, incorporate sodium bicarbonate 57; heat in an oven to 93–104° C. (199–219° F.), and when by careful manipulation with a wooden spatula the mixture is moist, rub through a No. 6 tinned-iron sieve, dry granules at 54° C. (129° F.). Should be kept in well-stoppered bottles.  
Dose, ʒj–2 (4–8 Gm.).

2. *Pulvis Acetanilidi Compositus*, 10 p. c.

PROPERTIES.—Tonic, stimulant, nervine, antiemetic; caffeine in small doses stimulates appetite, digestion, secretion of bile, quickens heart action, respiration, increases arterial tension, urine; normal doses, cerebral stimulant, causing nervous restlessness, wakefulness, increased mental activity. Large doses (gr. 5–10; .3–.6 Gm.) produce heaviness of head, insomnia, delirium, rapid, feeble pulse, cold extremities, elevated temperature, convulsions, paralyzes cardiac muscle, but death occurs from paralysis of respiration. It is a valuable hydragogue diuretic. Coffee is laxative, diuretic, antiperiodic, antiseptic. Used mostly, however, as a beverage, for which purpose alone about 1,500,000,000 pounds (680,272,110 Kg.) are consumed annually, making 1 pound (.46 Kg.) to every living person; in the United States about 6–7 pounds (2.7–3 Kg.) per capita, in Holland 10 pounds (4.6 Kg.).

USES.—Caffeine in neuralgia or nervous headaches, diarrhœa of cholera, phthisis, cardiac and renal dropsies, lithæmia, gout, insomnia of chronic alcoholism, adynamic fevers. Coffee in intermittents, asthma paroxysms, opium narcosis, to antagonize general torpor of nervous centres.

*Allied Plants:*

1. In addition to the official source, *Coffea arabica*, there are a number of species that furnish coffee, as *C. mauritia'na*, of Mauritius, *C. zangueba'ria*, of Zanzibar, Mozambique, etc., and *C. libe'rica*, of Liberia, this last being by far the most important of the three.

2. *Co'la acuminata*, *Cola Nut*.—Sterculiaceæ. W. Africa (see page 417); seeds contain caffeine 2 p. c., theobromine, tannin, volatile oil, etc.

3. *Paullin'ia Cupa'na*, *Guarana*.—Sapindacææ. Brazil (see page 398); seeds contain caffeine (guaranine) 4–5 p. c., tannin 2.6 p. c., starch, mucilage, fat, saponin, resin, volatile oil.

## IPECACUANHA. IPECAC.

<b>Cephaelis</b>	{ <b>Ipecacuanha</b> , ( <i>Brotero</i> ) <i>A. Richard</i> , <b>acuminata</b> , <i>Karsten</i> .	{ The dried root, also stem not exceeding 7 Cm. (3') in length, containing 2 p. c. of alkaloids.
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*Habitat.* Brazil to Bolivia, Columbia in damp forests; cultivated in India.

*Syn.* Hippo, Poaya; Br. Ipecacuanha Radix; Fr. Racine brésilienne, Ipécacuanha, Ipécacuanha annee (officinale), Radix ipecacuanhæ; Ger. Brechwurzel, Ruhrwurzel.

**Ceph-a-e'lis.** L. fr. Gr. κεφαλή, a head, + ἔλκω, to collect—i. e., flowers collected into a capitulum.

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**Ip'e-cac-u-an'ha.** L. fr. Braz. Indian name *ipecaquen*, which means "smaller roadside sickmaking plant."

**A-cu-mi-na'ta.** L. *acuminatus*, pointed, acute—i. e., apex of the leaves.

**Ip'e-cac.** An abbreviation of *ipecacuanha*.

**PLANT.**—Shrubby perennial; stem .3-.5 M. (12-18') high, with often .3 M. (12') additional underground, decumbent or erect, woody, knotted with leaf-scars, smooth and gray at the base, quadrangular, pubescent and green above, simple or branched; leaves few, 6-8, somewhat crowded at the top, 7.5-10 Cm. (3-4') long, 2.5-5 Cm. (1-2') broad, stipulate, opposite, petiolate, obovate, entire, wavy margins, dark green, smooth above, paler, pubescent, prominent veined beneath; flowers Jan.-Feb., small white dense heads, 8-20 together, funnel-shaped, hairy; fruit May, in clusters of dark purple berries 12 Mm. ( $\frac{1}{2}$ ') long, each with 2 small, plano-convex, stony seeds. **ROOT** (*Cephaëlis Ipecacuanha*), in irregular length pieces, rarely exceeding 25 Cm. (10'), stem-portion 2-3 Mm. ( $\frac{1}{12}$ - $\frac{1}{8}$ ') thick, light gray-brown, cylindrical, smoothish; root portion usually red-brown, occasionally blackish-brown, rarely gray-brown, 3-6 Mm. ( $\frac{1}{8}$ - $\frac{1}{4}$ ') thick, curved and sharply flexuous, nearly free from rootlets, sometimes branched, closely annulated with thickened, incomplete rings, usually with transverse fissures through the bark having vertical sides, fracture short, the very thick easily separable bark whitish, usually resinous, the thin tough wood yellowish-white, without vessels; odor very slight, peculiar, the dust sternutatory; taste bitter, nauseous, somewhat acrid; (*Cephaëlis acuminata*), very similar, but one-half thicker, dull gray, with thinner, merging annulæ, fractured surface of bark gray. **Solvents:** alcohol; water (injured by boiling). **Dose,** emetic, gr. 20 (1.3 Gm.) or gr. 5-10 (.3-.6 Gm.), repeated in 10-minute intervals, each being followed by hot chamomile tea; nauseant, diaphoretic, expectorant, gr. 1-2 (.06-.13 Gm.).

**ADULTERATIONS.**—**ROOT:** Roots of allied species, and portions of non-annulated woody stem; also roots of *Triosteum perfoliatum* and *Heteropterys pauciflora*, both resembling somewhat the official, the latter containing an inulin-like body instead of starch. **POWDER:** Starches, flour, almond-meal, etc., all of which can readily be recognized under microscope—the two first by their shaped granules, the last having scurvy testa, oil-cells, and yielding hydrocyanic acid when infused with water.

**Commercial.**—Sound ipecac in quality is proportionate to the thickness of the bark (75-90 p. c.), and the thinness of the wood (10-25 p. c.), as most of the alkaloids reside in the former; that with very thick bark is designated as "bold" (fancy), that with thick woody centre as "wiry"; the stem portion should not indicate having been leaf-bearing, as such parts exposed to light and air are always weaker in alkaloids. Ipecac was known first in Europe, 1672, as about this time Helvetius, a Dutch physician, became celebrated in Paris from its secret use; it was, however, in 1688, purchased from him by Louis XIV.

for 1,000 louis d'or (= \$4,600). It grows in rich loam of hot, moist forests, under trees in bunches, presenting two varieties according to its woody or herbaceous stems, the latter usually prostrate and covered with vegetable débris, otherwise exactly alike. This growth-habit produces a great distinction between the upper and lower stem-portions, causing the latter to be collected often with the root, when

FIG. 369.

*Orphaëlis Ipecacuanha.*

FIG. 370.



Ipecac root; normal size.

the product is termed "stemmy." The color of the roots of either kind is not uniform, both furnishing *brown*, *red*, and *gray*, which difference is only superficial, depending solely upon season of year collected, age, soil, climate, and mode of curing; the brown is least bitter and most abundant with us; the gray is most bitter and the larger. The root is collected at any time when the ground is soft (mainly Jan.-March), except in rainy weather, as then cannot dry properly, by *poayeros* (collectors, fr. Braz. name of the plant, *Poaya*), who catch the stem, pull it backward as far as possible, and thrust deep into the ground a stick with broad, sharp end, thus cutting the ramifications, but leaving sufficient roots to produce, from adventitious

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buds, new plants the following year. The plant-juice is so irritating as to produce sores upon the hands and elsewhere, consequently collectors only accept such labor in the absence of rubber-gathering, and that otherwise more congenial, thus accounting largely for the drug's high price. Roots are freed from adhering earth by shaking, put into bags, at night assorted, next day spread in the sun and carefully dried 3–4 days, being protected at night from heavy dews, then broken into small pieces, separated from any remaining earthy particles by sieves, and packed tightly in bags or hide-bound bales (seroons), which are stored carelessly awaiting sale—a condition, along with the incident exposure to damp weather and river-water in shipment, that renders three-fourths of the output considerably damaged by mouldiness. There are two commercial varieties: 1. *Rio, Brazilian, Para* (*C. Ipecacuanha*). This is distributed widely through Brazil, Bolivia, being collected chiefly in proximity to the Itenez River, and exported via Rio Janeiro or Para. 2. *Carthagera, Columbian* (*C. acuminata*). This grows wild mostly in Columbia, being exported chiefly via Carthagera; contains an equal amount of total alkaloids, but more cephaeline and less emetine than Rio.

**CONSTITUENTS.**—Alkaloids 2.28–3.36 p. c.: Emetine 2–3.14 p. c., Cephaeline 0.6 p. c., Psychotrine, Ipecacuanhic acid 2.25 p. c., choline, resin, starch 40 p. c., wax, fat, volatile oil, erythro-cephaelin (coloring matter), saccharose.

**Emetine (Methyl-cephaeline),**  $C_{15}H_{22}NO_2$ .—Obtained by adding basic lead acetate to alcoholic tincture, filtering, removing excess of lead with diluted sulphuric acid, neutralizing filtrate, distilling off alcohol, shaking out clear residual liquid with ether and ammonia; shake out ether solution with weak sulphuric acid, and shake repeatedly this acidulated solution with sodium hydroxide, in the presence of ether, until cephaeline (base soluble in caustic alkali) is completely separated. Emetine (base insoluble in caustic alkali) is converted into hydrochloride, recrystallized from water, and finally precipitated with ammonia. It is amorphous, white, becoming yellow by exposure, soluble in alcohol, ether, benzene, chloroform; forms salts, most of which are crystalline. Dose, expectorant, gr.  $\frac{1}{20}$ – $\frac{1}{10}$  (.0005–.001 Gm.); emetic, gr.  $\frac{1}{16}$ – $\frac{1}{8}$  (.004–.016 Gm.). Poisonous in large quantities; impure emetine is 10 times weaker.

**Cephaeline,  $C_{14}H_{20}NO_2$ .**—This is crystalline, white, becoming yellow by exposure, distinguished from emetine by its solubility in caustic alkalies and by being less soluble in ether; forms uncrystallizable salts. Dose, same as emetine.

**Psychotrine.**—This exists in ipecacuanha in small amount compared with two preceding alkaloids, and unlike them is only slightly soluble in ether; obtained by extracting with chloroform the ammoniacal liquid, from which emetine and cephaeline have been separated by ether; occurs in crystals which separate from ether in lemon-yellow transparent prisms, melts at 138° C. (281° F.), soluble in alcohol, chloroform.

**Ipecacuanhic Acid (Cephaelic Acid),  $C_{14}H_{18}O_7$ .**—An amorphous,



bitter glucoside, once believed identical with gallic acid, but more closely resembles caffeo-tannic acid; obtained by precipitating decoction with lead acetate, dissolving precipitate in acetic acid, then precipitating with lead subacetate; it is bitter, amorphous, brown, soluble in alcohol, green with ferric salts.

**Assay:** Exhaust finely powdered drug 15 Gm. by shaking 5 minutes with ether 115 Cc., chloroform 35, add ammonia water 3, shake, add distilled water 10, shake until powder in masses; shake out 100 Cc. solution with normal sulphuric acid V. S. 10, 3, reject ether, render acid liquid alkaline with ammonia water, shake out with ether 25, 20, 10; distil off ether from combined ethereal liquids, dissolve alkaloidal residue in 12 Cc.  $\frac{N}{10}$  sulphuric acid V. S., titrate with  $\frac{N}{50}$  potassium hydroxide V. S., + 5 drops hæmatoxylin T. S.; divide number Cc. of V. S. used by 5, subtract quotient from 12, multiply remainder by 0.0238, and this product by 10 = p. c. of alkaloids present.

**PREPARATIONS.**—1. *Fluidextractum Ipecacuanhæ*. Fluidextract of Ipecac. (Syn., Extractum Ipecacuanhæ Fluidum, U. S. P. 1890; Br. Extractum Ipecacuanhæ Liquidum; Fr. Extrait liquide d'Ipecacuanha; Ger. Flüssiges Ipecacuanhaextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 1.75 Gm. of alkaloids. **Assay:** From 10 Cc. evaporate off alcohol, when cool add 5 Cc. normal sulphuric acid V. S., stir, filter; to liquid in a separator add ether 20 Cc., render alkaline with ammonia water, shake, draw off aqueous and ether layers separately, shake out former with ether 10, 10, evaporate ether solutions, and proceed approximately as in assay of ipecac. **Dose,**  $\mathfrak{m}\text{j}$ –20 (.06–1.3 Cc.).

**Preps.:** 1. *Syrupus Ipecacuanhæ*. Syrup of Ipecac. (Syn., Fr. Sirop d'Ipecacuanha; Ger. Brechwurzelsirup, Ipecacuanhasirup.)

**Manufacture:** Mix fluidextract of ipecac 7 Cc., water 30, acetic acid 1, add to filtrate water q. s. 45, to which add glycerin 10, sugar 70 Gm., water q. s. 100 Cc. **Dose,** 3ss–4 (2–15 Cc.).

2. *Tinctura Ipecacuanhæ et Opii*. Tincture of Ipecac and Opium. (Syn., Fr. Teinture d'Ipecacuanha et d'Opium; Ger. Brechwurzel und Opiumtinktur.)

**Manufacture:** Evaporate tincture of deodorized opium 100 Cc. to 80 Gm., cool, add fluidextract of ipecac 10 Cc., filter, add diluted alcohol q. s. 100 Cc. **Dose,**  $\mathfrak{m}\text{v}$ –20 (.3–1.3 Cc.).

3. *Vinum Ipecacuanhæ*. Wine of Ipecac. (Syn., Br. Ipecacuanha Wine; Fr. Vin d'Ipecacuanha; Ger. Brechwurzelwein.)

**Manufacture:** Mix fluidextract of ipecac 10 Cc., alcohol 10, white wine 80, set aside two days, filter in well-covered funnel. **Dose,**  $\mathfrak{m}\text{j}$ –60 (.06–4 Cc.).

4. *Mistura Rhei et Sodæ*,  $\frac{1}{3}$  p. c.

2. *Pulvis Ipecacuanhæ et Opii*. Powder of Ipecac and Opium. (Syn., Dover's Powder; Br. Pulvis Ipecacuanhæ Compositus; Fr. Poudre de Dover; Ger. Pulvis Ipecacuanhæ opiat, Doversches Pulver, Pulvis Doveri.)

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*Manufacture*: 10 p. c. Mix ipecac 10 Gm., powdered opium 10, sugar of milk 80. Dose, gr. 5–10 (.3–.6 Gm.).

3. *Pilulæ Laxativæ Compositæ*,  $\frac{1}{16}$  gr. (.004 Gm.).

*Unoff. Preps.*: *Pilula Ipecacuanhæ cum Scilla* (Br.)—ipecac 5 p. c., opium 5 p. c., squill 20 p. c., ammoniac 20 p. c., potassium sulphate q. s. 100, dose, gr. 4–8 (.26–.5 Gm.). *Extract*, dose, gr.  $\frac{1}{20}$ – $\frac{1}{10}$  (.003–.03 Gm.). *Infusion*, 5 p. c., dose,  $\overline{3ss}$ –1 (15–30 Cc.). *Decoction*, dose,  $\overline{3ss}$ –1 (15–30 Cc.). *Troches*, each contains  $\frac{1}{8}$  gr. (.02 Gm.).

**PROPERTIES.**—Emetic, nauseant, expectorant, diaphoretic, sternutatory (chologogue, antiseptic, hæmostatic, counter-irritant). Small doses (gr.  $\frac{1}{8}$ – $\frac{1}{4}$ ; .008–.016 Gm.), stomachic, tonic; large doses (gr. 5–20; .3–1.3 Gm.), emetic in 30 minutes, not violent nor depressing; if doses repeated, have tolerance, catharsis; may cause irritation, hemorrhage. Emetine kills animals by cardiac paralysis. Vomiting due to local irritation of the stomach and a direct action upon vomiting centre in the medulla; it increases, by stimulation, the secretion of bile, bronchial and intestinal mucus.

**USES.**—Acute indigestion, nauseating bilious headache, small doses for bronchitis, whooping-cough, asthmatic catarrh, spasmodic croup (here syrup given until vomiting occurs), spasmodic asthma, pneumonia, rigidity of os uteri, hæmoptysis, hemorrhage, atonic dyspepsia, vomiting in pregnancy (hourly  $\overline{Mj}$ ; .06 Cc. of wine), catarrhal jaundice (gr. 20; 1.3 Gm. daily), chronic dysentery, diarrhœa, hectic sweats, cholera, cholera morbus, remittent fever, urticaria, cases of poisoning; locally in ophthalmia (decoction). As diaphoretic and expectorant give at long intervals; the syrup always to infants. Its action is somewhat irregular, gr. 5 (.3 Gm.) sometimes being as effective as gr. 15 (1 Gm.). Emetine gr.  $\frac{1}{10}$  (.006 Gm.) has induced vomiting, while gr. 12 (.8 Gm.) given in 24 hours have caused no unpleasant symptoms.

**Poisoning**: Usually have severe vomiting of stomach contents, mucus, blood, etc. Unless thoroughly vomited, wash out stomach with tannin solution, if necessary follow with opium, belladonna, cardiac stimulants.

**Incompatibles**: Lead and mercury salts, vegetable acids, astringent infusions, bismuth compounds, phenol (carbolic acid), and hydrocyanic acid.

**Synergists**: Emetics, sedative expectorants, warm drinks.

**Allied Plants**:

1. *Psycho'tria emet'ica*, *Striated Ipecac.*—Root 6 Mm. ( $\frac{1}{4}$ ') thick,

FIG. 371.

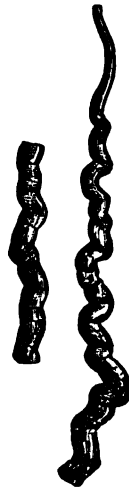


FIG. 372.



Undulated ipecacuanha. Striated ipecacuanha.

longitudinally wrinkled, not annulate, transverse fissures through bark, purplish-brown; bark thick. Contains little emetine, much

FIG. 373.



*Rubia tinctorum*: 1, open flower: 2, longitudinal section of flower enlarged; 3, ovary; 4, cross-section of ovary; 5, longitudinal section of ovary; 6, fruit.

sugar, no starch. There is a small striated ipecac (a species of *Richar'd(son)ia*) 3 Mm. ( $\frac{1}{8}$ ') thick, otherwise same as the ordinary striated.

2. *Richar'd(son)ia sca'bra*, *Undulated* or *Farinaceous Ipecac*.—Undulate wrinkled; annulate, transversely fissured, brownish-gray; bark white, mealy, not bitter, wood nearly as thick as the bark.

3. *Calceola'ria* (*Ionid'ium*) *Ipecacuanha*, *White Ipecac*.—Violaceæ. Branched, not annulate, longitudinally wrinkled, whitish-yellow; wood porous, thick, yellowish, no starch.

4. *Ascle'pias curassav'ica*, *Bastard Ipecac*.—C. and S. America has short rootstock abruptly divided into many yellowish rootlets.

5. *Ru'bia tincto'rum*, *Madder*.—The root, official 1820–1880. S. Europe, Asia. Perennial herb, square stem, covered with short prickles by which it climbs; leaves elliptical, 7.5 Cm. (3') long; flowers yellow; root creeping, 5 Mm. ( $\frac{1}{4}$ ') thick, reddish, sweetish, bitter, acrid, astringent taste; contains rubian (yellow), alizarin (orange-red), ruberythrin (yellow needles, blood-red with alkalies), purpurin. Used as tonic, diuretic, emmenagogue in dropsy, amenorrhœa, rachitis, dyeing. Dose, gr. 15–60 (1–4 Gm.).

## CINCHONA. CINCHONA.

1. CINCHONA. Cinchona.

2. CINCHONA RUBRA. Red Cinchona.

Cinchona	{	Ledgeriana and hybrids, Moens,	{	Containing 5 p. c. anhydrous alkaloids, four-fifths being soluble in ether.	The dried bark.
		Calisaya and hybrids, Weddell, officinalis and hybrids, Linné,		Containing 5 p. c. anhydrous alkaloids.	
		succirubra or its hybrids, Pavon,		and other species of Cinchona.	

*Habitat.* S. America; cultivated in Java, India, Jamaica, Ceylon, W. Africa.

*Syn.* 1. Yellow (Cinchona) Bark, Peruvian Bark, Jacket, Carthagena, Bicolorata, Huamielies, Loxa (Loja), Pale Crown, Silver Crown, Maracaibo, Pitaya, Red Cartha-

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gena, Bogota, Black Coquette, White Crown, Lima, Huanuco; Fr. Quinquina (Calisaya) jaune Royal; Ger. China Regia, Calisayarinde, Königschina. 2. Red Cinchona or Saint Ann's bark; Br. Cinchonæ Rubræ Cortex; Fr. Quinquina; Ger. Cortex Chinæ, Chinarinde, Peruvianische Rinde, China.

Cin-cho'na, better *Chinchona*, after Countess Ana de Osorio, wife of fourth Count of Chinchon, Spanish Viceroy of Peru (Chinchon, a town in Spain, near Madrid). She was cured in 1638 of tertian fever by this bark, through recommendation of a Jesuit; in 1640 she brought it to Europe, extolled its virtues, and thus published the hitherto Jesuit secret.

Ledg-er-i-a'na. L. Ledgerian, of or belonging to Ledger—i. e., after C. Ledger, who in 1865 obtained the seed from the Caupolican province, Bolivia.

Cal-i-sa'ya. Name given the bark by Spaniards and Indians.

Of-fi-ci-na'lis. L. see etymology of (*Asagraea*) *officinalis*, page 101.

Suc-ci-ru'bra. L. *succus*, juice, + *ruber*, red—i. e., sap first colorless, then white, and red on exposure.

Quina (Gheena), Peruv. Indian name for bark; *quina-quina* = medicinal bark; this name they apply also to other barks, and from it comes Fr. Quinquina; Ger. China, very similar to Sp. *cascarilla*, dim. of *cascara*.

**PLANTS.**—Some 36 species have been recognized, but the 4 official varieties are the best producers; at the same time the following may be considered in order of importance:

1. Yellow—*Cinchona Ledgeriana* and *C. Calisaya*.
2. Pale Crown Loza—*Cinchona officinalis*, var. (a) *Condamineae*, (b) *Bonplandiae*, (c) *crispae*.
3. Red—*Cinchona succirubra*.
4. Gray—*Cinchona nitida*, *C. micrantha*, *C. peruviana*.
5. Colombian—*Cinchona pitayensis*, *C. lancifolia*, *C. cordifolia*.

All are evergreen trees, 12–24 M. (40–80°) high, .3–.6 M. (1–2°) thick at base; leaves laurel-like, entire, varying shape, the best pitted or scrobiculate on underside (except *succirubra*), midrib prominent, petiole and lamina often purplish when young or old; flowers tubular, fragrant, rosy-white, purplish, 5-divided; fruit capsule, 2-celled, splitting from base upward, containing many flat and winged seeds.

**BARK.**—1. *C. Ledgeriana*, and *C. Calisaya*. In quills, curved pieces of variable size, usually 2–5 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ') thick, gray, rarely brownish-gray, with numerous intersecting transverse and longitudinal fissures, having nearly vertical sides but no strong ridges ("chicken-leg appearance"); when outer bark absent then cinnamon-brown; inner surface light cinnamon-brown, finely striate, fracture of outer bark short, granular, of inner finely splintery; bast fibres scattered, spindle-shaped, medium size, mostly singly, a few in 2's and 3's, medullary rays narrow; laticiferous ducts only in young (inferior) samples; powder light- or yellowish-brown; odor slight, aromatic; taste bitter, astringent. Distinguished by profuse reticulations of fine intersecting fissures with vertical sides, absence of strong ridges. This variety is increasing in demand, as it is the richest in quinine, which constitutes about 75 p. c. of its total alkaloids.

2. *C. officinalis*.—In quills, single or double, of variable size, usually 10–25 Mm. ( $\frac{2}{3}$ –1') broad, bark 2–4 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ') thick, always notable for its thickness compared with size of quills; periderm gray-brown

(Huanuco), blackish (best Loxa), longitudinal wrinkles rather strong, irregular in direction, usually shaggy with gray and yellowish-green lichens—a sign of good quality, without fissures, or sparsely transversely fissured, fissures short, gaping, not intersecting; inner surface yellowish-brown, nearly smooth, fracture short, fibrous zone narrow, bast fibres few in groups of 3–6, medium size, stone-cells rare, laticiferous

FIG. 374.

*Cinchona succirubra.*

ducts wanting except in the youngest bark. Distinguished by strong longitudinal wrinkles, the slanting sides of the transverse fissures when present, and versatility of the lichens; taste moderately bitter, powder pale brown. Bark now comes from cultivated good-sized trees, more fissured and reddish—possibly a hybrid.

3. *C. succirubra*.—In quills, curved pieces of variable size, bark

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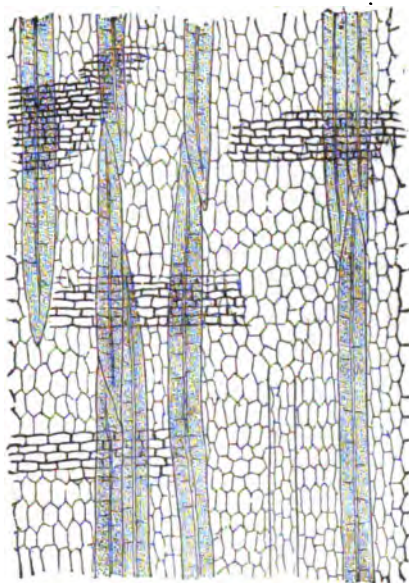
2–5 Mm. ( $\frac{1}{12}$ – $\frac{1}{8}$ ) thick, gray or grayish-brown, roughish from longitudinal rows of warts, or from warty ridges which are sometimes fissured, transverse fissures rarely numerous or much intersected and having sloping sides; inner surface reddish or orange-brown, distinctly striate, fracture short, granular in the outer, shortly and coarsely splintery in the inner bark; slightly odorous; taste bitter, astringent; powder reddish-brown. Distinguished by strong longitudinal ridges which sometimes become fissured, absence of other fissures, those

FIG. 375.



Calisaya bark, showing digital furrow and short fibrous fracture.

FIG. 376.



Calisaya bark: radial longitudinal section through liber, showing cinchona bast fibres, bast parenchyma, and medullary rays; magnified 60 diam.

present rarely intersecting; bast fibres spindle-shaped, coarse, in groups of 2–5, often more, row of laticiferous ducts in outer bark. This variety is greatly on the decline, and while it is rich in alkaloidal yield, only 20–40 p. c. is quinine, the remainder being mostly cinchonidine with some cinchonine and quinidine. *Solvents*: acidified water; alcohol (65 p. c.). Dose, gr. 15–60 (1–4 Gm.).

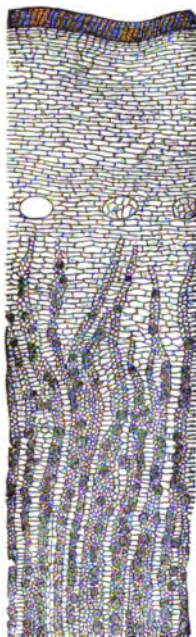
**ADULTERATIONS.**—Inferior grades through ignorance, substituting one variety for another by intention, Maracaibo for the yellow; barks treated with ammonia gas (thereby producing cinchona-red) for red bark; powder with residual inferior barks.

**Commercial.**—Cinchona plants natively always hug mountain sides; in S. America, from 10° north latitude to 20° south latitude, on the eastern slope of central Andes chain, from Bolivia to Peru, Ecuador, also on east slope of western Cordilleras chain, thence to the highlands



of Colombia, Venezuela, to Caracas and Caribbean Sea. The best flourish where mean annual temperature is  $13^{\circ}\text{C}$ . ( $55^{\circ}\text{F}$ .) where the

FIG. 377.



*Cinchona succirubra*:  
transverse section of  
bark, magnified 30 diam.

FIG. 378.



*Cinchona succirubra*: natural quill; d, transverse section

rainy season is 9 months, in which rainfall is heavy at night and the days vary between sunshine and fog; for the other 3 months (Jan., Feb., March) nights are frequently below freezing, days  $24^{\circ}\text{C}$ . ( $75^{\circ}\text{F}$ .), with dense fogs. Less valuable species flourish where moisture is not so uniform and average temperature is  $20^{\circ}\text{C}$ . ( $68^{\circ}\text{F}$ .). All locations must be well drained, hence no species flourish in valleys, but on forest slopes, singly or few together, elevated 1,500–2,400 M. (5,000–8,000°); *C. barbacen'cis*—most worthless species, so low as 100 M. ( $330^{\circ}$ ); *C. succirubra* is valuable at 700 M. ( $2,300^{\circ}$ ); some do well at 3,500 M. ( $11,500^{\circ}$ ). Their area is limited to within 11 degrees to the north and south of Loja (Loxa), outside of which territory barks are almost worthless; the most southern being *C. australis*, the most northern *C. tucujen'sis* and *C. cordifolia*. The alkaloids reside largely in the cork, although the

bast-layer of old bark contains considerable, while that of young bark absolutely none; the root-bark of all species is the richest, and that of branches the poorest.

**Cultivation.**—*Cinchona* trees, growing natively in mountain forests along with bamboos, begonias, coca, fuchsias, orchids, palms, tree ferns, etc., mostly unprotected and without owners, as a rule became common property and a prey to mercenary parties who had little regard to future production. The demand was increasing, the supply decreasing, and it was only a question of time when the destruction would be complete; naturally, this condition aroused the concern of medical and other scientific men. The natives guarded this indigenous inheritance with a jealous eye, thus trying to prevent the visitation of foreigners and the possibility of its ever being transplanted. It was surmised correctly that the trees would flourish wherever climatic and other conditions were somewhat similar, so in 1737 La Condamine first attempted the experiment, but with failure; Dr. Weddell, 1846–1847, sent seeds to France which yielded only ornamental plants; Mr. Hasskarl (Dutch), 1853, was the first to obtain practical results from

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the plants he collected and sent to Batavia, being aided by Junghuhn. Then followed Markham (English, 1859, Ledger, Spruce, Cross, and others. Each of these gentlemen, in visiting, at various times, S. America, procured seeds, cuttings, etc., which were sent to India, Ceylon, Java, where now three-fourths of the bark is grown by cultivation. In fact, native bark is so poor in alkaloidal strength (2–4 p. c.) that it constitutes only about 5 p. c. (1 p. c. from wild, 4 p. c. from cultivated plants) of the sum-total bark annually used. And since all demand is for cultivated tree-bark, its commerce has been revolutionized in quantity, quality, and price. This genus hybridizes well, so that species and varieties have been formed yielding 5, 10, 15 p. c. total alkaloids (red 5–8–11 p. c.), and those yielding only 3–4 p. c. are, in S. India and Java, uprooted by whole plantations and replaced by supposed richer hybrids. Propagation by cuttings is slow, so seeds are planted in nurseries, scions grafted and transplanted into orchards, which are cared for like cultivated fruit trees. *C. Calisaya*, and *C. Ledgeriana* (by some considered only a variety of the former) are the species, owing to their richness in quinine, mostly cultivated, the latter largely predominating, while *C. succirubra* has almost been abandoned. Most of the cultivated bark is grown in Java, considerable in India; formerly a great deal was produced in Ceylon, but a disease fatal to the trees and the substitution of tea-planting have almost eliminated that supply; Bolivia and the Straits Settlements furnish some. When trees about 15 years old the bark becomes more or less worthless, consequently they are cut down and replaced. The mountains most adapted for this cultivation are Neilgherry, Himalaya, and Blue.

*Collection.* 1. *Wild S. American Bark.*—Formerly this was collected by gangs of *cascarilleros*, managed for companies by major-domos. Each gang left the seacoast in dry weather on donkeys, for the distant mountains, being away several months; and upon arriving in the cinchona districts, encamped near a stream, planted corn and beans, built huts, and depended upon game for meat. Having with a mallet loosened, then removed the trunk-bark, the tree was felled and entirely stripped of bark, which was carried to the huts and in the sun or under shelter allowed to dry in quills or in pieces pressed flat by rocks. When dried, the best was put in canvas bundles (150 pounds; 70 Kg.) and the return trip begun. At the coast ports these bundles were sewed up in fresh hides, forming, when dry, tight seroons, which were shipped as such, or in bales or boxes, from Guayaquil, Payta, Lima, Carthagena,

FIG. 379.



Cinchona bast fibres.

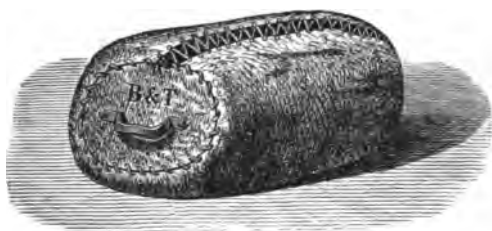


Santa Marta, Buenos Ayres, etc. Bolivia is the only local country in which the trees are cultivated.

2. *Cultivated India Bark*.—This is cared for and collected in several ways: (a) *Uprooting*. This consists in pulling up and barking whole tree and replanting the ground, the bark of each tree-part being marketed separately. (b) *Coppicing*. Mostly practised, and consists in felling trees, allowing shoots to spring from the stumps, and collecting the bark as soon as "ripe," when plants 6–9 years old and trunks 15–20 Cm. (6–8') thick—as such furnishing when in quills, "Druggists' bark," or when broken up and compressed to save transportation charges, "Manufacturers' bark," being purchased upon assay-unit, each unit corresponding to 1 p. c. of quinine in a pound (.5 Kg.). (c) *Shaving*. The outer bark of plants 3–5 years old is shaven off with drawing-knives, leaving intact the liber, upon which another growth of richer bark soon forms. (d) *Mossing*. Alternating strips are taken off yearly, and the decorticated portion covered with moss, grass, straw, hay, rags, paper, etc.; this gives an annual yield of rich bark (*mossed, renewed*) during the tree's entire life. Bark thus covered is stronger in alkaloids, as it prevents the sun converting the alkaloids into coloring matter, especially on the side most exposed to direct rays (most quinine and quinidine in bark from trees grown in mid-woods (shade), most cinchonidine and cinchonine from trees exposed to sun). The last two

methods not only furnish richest bark, but also replace it rapidly; at the same time they have the drawback of exposing the new-forming bark-cells to the attack of stag-beetles, ants, etc. In 1902 cinchona bark was exported as follows: Java 14,726,000 pounds (6,693,190 Kg.); India 1,020,000 pounds

FIG. 380.



*Cinchona seroon*.

(63,640 Kg.); Ceylon 407,000 pounds (185,000 Kg.); S. America 775,000 pounds (352,273 Kg.); Africa 178,872 pounds (81,305 Kg.). Most of the cultivated bark is in quills, whereas most of the wild-grown was in large pieces (*tabla*), thereby rendering examination easy.

CONSTITUENTS.—From 21–32 natural alkaloids: Quinine, Quinidine, Cinchonine, Cinchonidine, Quinamine, Chinoidine, (Conquinamine, Cupreine, Homoquinine, Hydroquinine, Paytine, Concusconine, etc.); 8 artificial alkaloids: Quinicine, Cinchonicine, Quinamicine, Apoquinamine, etc., Quinic acid, Quinovioic acid, Cincho-tannic acid, Quinovio, Cinchona-red, volatile oil, resin, starch, gum, sugar, wax, calcium oxalate, ash 1–3 p. c.

The first 4 alkaloids are the most important, and can be obtained by mixing a concentrated infusion of cinchona with milk of lime, whereby this latter combines with the acids and coloring matter, thus libera-

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ting the alkaloids; now strain, and exhaust the residue with boiling alcohol, (benzin, kerosene), acidify with sulphuric acid, treat with animal charcoal, filter, and while hot neutralize with sodium hydroxide V. S., when quinine sulphate crystallizes out. To the mother-liquor add large excess of ammonia water, which precipitates cinchonine and cinchonidine, while quinidine remains in solution; dissolve the precipitate in boiling alcohol, and upon cooling cinchonine separates; by evaporating the two solutions we get on the one hand cinchonidine, and on the other quinidine. The respective salts can be prepared by dissolving the several alkaloids in water, adding sufficient of the desired acid for neutralization, then allowing to crystallize.

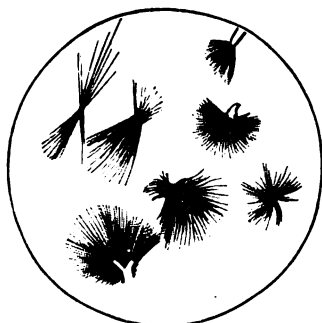
**Quinina, Quinine**,  $C_{20}H_{24}N_2O_2 + 3H_2O$ , *official*.—(Syn., Chininum; Fr. Quinine; Ger. Chinin.) This alkaloid, obtained from the bark of various cinchona species, may be prepared by precipitating a solution of quinine sulphate in acidified water with an alkali, thereby yielding the anhydrous, white, curdy, amorphous alkaloid, which by being kept under water changes to the crystalline form. It is a white, flaky or micro-crystalline powder, odorless, bitter taste, soluble in 1,550 parts water, 0.6 alcohol, 1.3 ether, 1.6 chloroform, 212 glycerin, 166 benzene, 1,810 ammonia water, diluted acids. *Tests*: 1. Aqueous solution 1 Cc. (1 in 100) + diluted sulphuric acid for solution + 2 Cc. bromine T. S. + 1 Cc. ammonia water should give emerald-green color (thalleioquin). 2. 1 Gm. dissolved in 6 Cc. alcohol + 3 Cc. ether, slightly warmed, should remain clear on cooling (abs. of cinchonine, cinchonidine). 3. With sulphuric acid get faint yellow but blue fluorescence (abs. of organic impurities); with nitric acid no red color (dif. from morphine). 4. When heated should lose water 14.3 p. c. (abs. of excess water); no ammonia should be evolved (abs. of ammonium salts). Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 1–20 (.06–1.3 Gm.).

**Quininæ Bisulphas, Quinine Bisulphate**,  $C_{20}H_{24}N_2O_2 \cdot H_2SO_4 + 7H_2O$ , *official*.—(Syn., Quininæ Sulphas Acidus; Fr. Sulfate acide (Bisulfate) de Quinine; Ger. Chininum bisulfuricum, Saures Chininsulfat.) Obtained by dissolving quinine sulphate (100) in warm distilled water (500) + diluted sulphuric acid (115), set aside to crystallize. It is in colorless, transparent or whitish, orthorhombic crystals or small needles, odorless, bitter, effloresces and turns yellow on exposure, no residue, soluble in 8.5 parts water, 18 alcohol, 1,770 ether, 920 chloroform, solutions show blue fluorescence. *Tests*: 1. Barium chloride T. S. gives white precipitate, insoluble in hydrochloric acid. 2. With bromine T. S. + ammonia water get emerald-green color (thalleioquin). Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 1–20 (.06–1.3 Gm.).

**Quininæ Hydrobromidum, Quinine Hydrobromide**,  $C_{20}H_{24}N_2O_2 \cdot HBr + H_2O$ , *official*.—(Syn., Quininæ Hydrobromas, U. S. P. 1890; Fr. Bromhydrate de Quinine (basique); Ger. Chininhydrobromat, Bromwasserstoffsaures Chinin.) Obtained by double decomposition of quinine sulphate and barium bromide, in hot water. It is in white,

light, silky needles, odorless, bitter, soluble in chloroform, 40 parts water, 0.67 alcohol, 16 ether, 8 glycerin, effloresces, solutions show blue fluorescence, no residue. *Test*: 1. Precipitate saturated aqueous solution with sodium hydroxide T. S., supersaturate with acetic acid, add chloroform + little chlorine water, shake, when chloroform separates with yellow color. Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 1–20 (.06–1.3 Gm.).

FIG. 381.



Quinine sulphate: microscopic crystals.

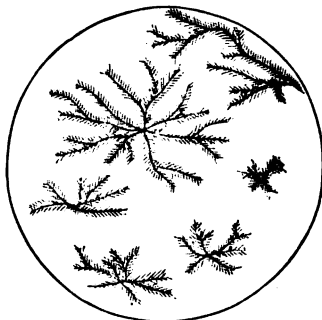
FIG. 382.



Quinine sulphate with KSCy: microscopic granules.

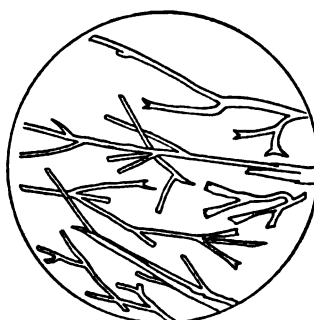
**Quininæ Hydrochloridum, Quinine Hydrochloride,  $C_{20}H_{24}N_2O_2 \cdot HCl + H_2O$ , official.**—(Syn., Quininæ Hydrochloras, U. S. P. 1890, Muriate of Quinine; Fr. Chlorhydrate de Quinine (basique); Ger. Chininum hydrochloricum, Chininhydrochlorid, Salzaures Chinin.) Obtained by dissolving quinine in warm diluted hydrochloric acid

FIG. 383.



Quinidine sulphate with KSCy: microscopic crystals.

FIG. 384.



Cinchonine sulphate with KSCy: microscopic crystals.

until solution neutral, crystallizing; or by double decomposition of quinine sulphate and barium chloride, in hot water. It is in white, silky, glistening needles, odorless, bitter, soluble in 18 parts water, 0.6 alcohol, 240 ether, 0.8 chloroform, 8 glycerin, effloresces; very dilute and acidified ( $H_2SO_4$ ) solutions show blue fluorescence, no residue.

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**Tests:** 1. Silver nitrate T. S. gives white precipitate, insoluble in nitric acid. 2. Aqueous solution + barium chloride T. S. should not be more than slightly turbid (lim. of sulphate). Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 1–20 (.06–1.3 Gm.).

**Quininæ Salicylas, Quinine Salicylate,**  $C_{20}H_{24}N_2O_2 \cdot HC_7H_5O_3 + H_2O$ , *official.*—(Syn., Fr. Salicylate de Quinine (basique); Chininsalicylat, Salicylsaures Chinin.) Obtained by dissolving quinine sulphate (10) in boiling water (75), add sodium salicylate (3.89) dissolved in water (30), wash precipitate. It is in colorless needles, permanent, turning pinkish by age, soluble in 77 parts water, 11 alcohol, 110 ether, 37 chloroform, 16 glycerin, no residue, solutions show blue fluorescence. **Tests:** 1. Aqueous solution + 1 drop ferric chloride T. S. gives violet color. 2. Dilute aqueous solution 10 Cc. + 3 Cc. bromine T. S. + excess ammonia water gives emerald-green color (thalleioquin). Should be kept dark, in well-stoppered, amber-colored bottles. Dose, gr. 1–20 (.06–1.3 Gm.).

**Quininæ Sulphas, Quinine Sulphate,**  $(C_{20}H_{24}N_2O_2)_2 \cdot H_2SO_4 + 7H_2O$ , *official.*—(Syn., Quinæ Sulphas, Sulfas Quinicus; Fr. Sulfate de Quinine; Ger. Chininum sulfuricum, Chininsulfat, Schwefelsaures Chinin.) Obtained by exhausting powdered bark with acidified water ( $HCl, H_2SO_4$ ), precipitating with an alkali; or by mixing powdered bark with milk of lime, dissolving out alkaloids with petroleum oil, treating with diluted sulphuric acid, neutralizing with sodium carbonate, crystallizing. It is in white, silky, light, flexible, glistening crystals, or hard, prismatic, monoclinic needles, odorless, bitter, soluble in 720 parts water, 86 alcohol, 400 chloroform, 36 glycerin, slightly in ether, effloresces, no residue, solutions show blue fluorescence. **Tests:** 1. Barium chloride T. S. gives white precipitate, insoluble in hydrochloric acid. 2. Dissolve 1 Gm. in 7 Cc. of mixture 2 volumes chloroform + 1 alcohol, with heat, upon cooling should remain clear (abs. of ammonium sulphate, inorganic salts). 3. 1 Gm. dried, should give residue 0.838 Gm. (ind. 8 molecules water—16.18 p. c.). Should be kept dark, in well-stoppered, amber-colored bottles. Dose, gr. 1–20–40 (.06–1.3–2.6 Gm.). In 1904 the quinine of the world was produced by 20 factories: 5 in France, 4 in America, 3 in England, 2 in Germany, 2 in Italy, 1 each in Bengal, Holland, Java, Madras Presidency; in 1902 Madras manufactured 15.711 pounds (7.141 Kg.), Bengal 11.297 pounds (5.135 Kg.), Java 43.750 pounds (19.886 Kg.).

**Quinidina, Quinidine,**  $C_{20}H_{24}N_2O_2$ .—This is isomeric with quinine, is fluorescent; with chlorine or bromine water + ammonia water gives emerald-green color or precipitate, and is precipitated from the other alkaloids by potassium iodide, but not by alkaline oxalates in neutral solution; forms numerous salts, sulphate, bisulphate, hydriodide, etc. Dose, gr. 1–30 (.06–2 Gm.).

**Cinchonina, Cinchonine,**  $C_{19}H_{22}N_2O$ .—It is in white lustrous prisms or needles, odorless, at first nearly tasteless, becoming bitter, soluble in 116 parts alcohol, 3,760 water, 163 chloroform, 526 ether,

no residue, precipitated from acid solution by ammonia water by which it is sparingly dissolved, but soluble in 300 parts ether (dif. from quinine, quinidine, cinchonidine). Dose, gr. 1–30 (.06–2 Gm.).

**Cinchoninæ Sulphas, Cinchonine Sulphate**,  $(C_{19}H_{22}N_2O)_2H_2SO_4 + 2H_2O$ , *official*.—(Syn., Cinchoninæ Sulphas; Fr. Sulfate de Cinchonine; Ger. Cinchoninum sulfuricum, Cinchoninsulfat, Schwefelsaures Cinchonin.) It is in hard, white, lustrous, prismatic crystals, odorless, bitter, permanent, soluble in 58 parts water, 10 alcohol, 2,300 ether, 69 chloroform, at 100° C. (212° F.) loses water of crystallization, melts at 198° C. (389° F.), no residue, aqueous solution shows no fluorescence, dextrogyrate. *Tests*: 1. Dissolved in diluted sulphuric acid (1 in 1,000) should not exhibit more than faint blue fluorescence (lim. of quinine or quinidine sulphates). 2. 1 part agitated with 80 chloroform should dissolve (lim. of quinine or cinchonidine sulphates). 3. 1 Gm. when dried should weigh 0.95 Gm.; should dissolve in sulphuric acid with only faint yellowish tinge. Dose, gr. 1–30 (.06–2 Gm.).

FIG. 385.

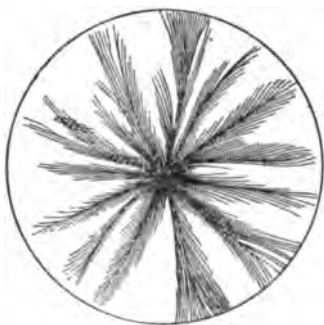
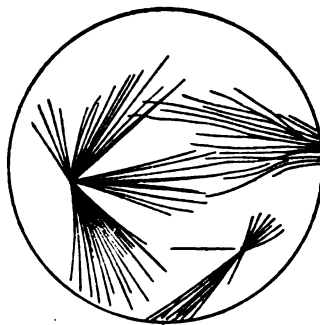


FIG. 386.



Cinchonidine sulphate with KSCy: microscopic crystals.

**Cinchonidina, Cinchonidine**,  $C_{19}H_{22}N_2O$ .—This is isomeric with cinchonine, is non-fluorescent; with chlorine or bromine water + ammonia water get white color or precipitate; soluble in 20 parts alcohol, 188 ether, 1,600 water, precipitated from its associated alkaloids by sodium tartrate. Dose, gr. 1–30 (.06–2 Gm.).

**Cinchonidinæ Sulphas, Cinchonidine Sulphate**,  $(C_{19}H_{22}N_2O)_2H_2SO_4 + 3H_2O$ , *official*.—(Syn., Fr. Sulfate de Cinchonidine; Ger. Cinchonidinum sulfuricum, Cinchonidinsulfat.) It is neutral, in white glistening, silky needles or prisms, odorless, bitter, permanent, soluble in 63 parts water, 72 alcohol, 4,400 ether, 900 chloroform, at 100° C. (212° F.) loses water of crystallization, melts at 205° C. (401° F.), no residue, ammonia water added to aqueous solution gives white precipitate (cinchonidine) slightly soluble in ammonia, and soluble in 10 parts ether, the greater part afterwards separating in crystals. *Tests*: 1. With barium chloride T. S. gives white precipitate insoluble in hydrochloric acid. 2. Diluted sulphuric acid solution (1 in 1,000)

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should give only faint blue fluorescence (abs. of more than traces of quinine or quinidine sulphates). 3. 0.5 Gm. + 20 Cc. water, macerate, agitate, add 0.5 Gm. potassium and sodium tartrate, shake occasionally for an hour, to filtrate add 1 drop ammonia water, should get only slight turbidity (abs. of more than traces of cinchonine and quinidine sulphates). Dose, gr. 1–30 (.06–2 Gm.).

**Quinami(n)a, Quinamine**,  $C_{19}H_{21}N_2O_2$ .—In long white prisms, non-fluorescent, nearly tasteless, acid solution very bitter, soluble in ether, hot alcohol.

**Chinoidinum, Chinoidine, Quinoidine**.—Official 1880–1890. A blackish amorphous alkaloid, resulting from evaporation of mother-liquor of the preceding alkaloids, and precipitating with sodium hydroxide—purify by dissolving in dilute hydrochloric acid, precipitating by ammonia, washing, drying; it is one-half the strength of quinine. Dose, gr. 2–30 (.13–2 Gm.).

**Quinic Acid (Kinic, Chinic or Cinchonic)**,  $C_7H_{12}O_6$ .—5–9 p. c.

**Quinovic Acid (Kinovic)**,  $C_{32}H_{48}O_6$ .—Tasteless shining crystals.

**Cincho-tannic Acid (Quino-tannic)**,  $C_{14}H_{16}O_9$ .—3–4 p. c.

The alkaloids are combined with one or more of these acids; the first acid (quinic) with sulphuric acid and manganese dioxide yields kinone,  $C_6H_4O_2$ ; the first and second (quinic and quinovic) produce quinates (kinates) and quinovates (kinovates), as quinate (kinate) of quinine, lime, etc.; the last (cincho-tannic) is a glucoside, and is the soluble red coloring matter; when boiled with sulphuric acid gives sugar and cinchonic-red.

**Quinovin (Kinovin, Chinovin, Quinovic Bitter)**,  $C_{30}H_{48}O_8$ .—Bitter glucoside; to alcoholic solution add hydrochloric acid gas, get quinovic (kinovic) acid and quinovin (kinovin) sugar (mannitan).

**Cinchona-red**,  $C_{28}H_{22}O_{14}$ .—This is from cincho-tannic acid; is soluble in alcohol and alkaline solutions. Red cinchona bark may contain 10 p. c.

**Assay**: Exhaust cinchona, fine powder (15), with alkaline (ammonia water 10) solution of ether (125) and chloroform (25), shaking frequently for 5 hours, shake out 100 Cc. supernatant liquid with normal sulphuric acid V. S., filter acid solution, washing filter with water q. s. 50 Cc., divide this equally into two separators: 1 and 2. Shake out No. 1 with 3 portions (25, 20, 10) of alkaline (ammonia) solution of chloroform (3) and ether (1), draw off chloroform-ether solution, evaporate to dryness, multiply weight of residue in grammes by 20 = p. c. total alkaloids. Shake out No. 2 with alkaline (ammonia) ether (25), after liquids separate draw off and reject lower aqueous layer, evaporate ethereal liquid to dryness, multiply weight of residue in grammes by 20 = p. c. ether-soluble alkaloids (quinine, quinidine, cinchonidine). Several other less complicated methods have heretofore been used: 1. That of the U. S. P. 1890 consisted in macerating 4–6 hours with occasional agitation, powdered bark with a mixture of alcohol (19), chloroform (5), ammonia water (1), evaporating filtrate, dissolving residue in acidulated water, precipitating with potassium hydroxide V. S.;

the precipitate may be dissolved in chloroform, evaporated. 2. That of the U. S. P. 1880 consisted in mixing powdered bark with  $\text{Ca}(\text{OH})_2$  and water to a thin paste, macerating several days, evaporating to dryness, digesting mass in alcohol (or benzene 3 vols. + amyl alcohol 1) until exhausted; to filtrate add sulphuric or hydrochloric acid, distil off alcohol, precipitate with sodium hydroxide. 3. Percolate drug with acidulated ( $\text{HCl}$ ) water, precipitate with sodium hydroxide.

PREPARATIONS.—I. CINCHONA (*C. Calisaya*, *C. Ledgeriana*, *C. officinalis*): 1. *Fluidextractum Cinchonæ*. Fluidextract of Cinchona. (Syn., *Extractum Cinchonæ Fluidum*, U. S. P. 1890; Br. *Extractum Cinchonæ Liquidum*, *Extractum Chinæ Calisayæ Fluidum*; Fr. *Extrait liquide de Quinquina jaune*; Ger. *Flüssiges Chinaextrakt*, *Kalisaya-rindenextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 80 Cc., water 10, glycerin 10, finishing with alcohol 80 p. c., q. s., evaporate to 100 Cc.; when assayed each 100 Cc. should contain 4 Gm. of anhydrous ether-soluble alkaloids. *Assay*: To 10 Cc. add ether 100 Cc., chloroform 25, ammonia water 10, shake, decant into separator 66 Cc. supernatant liquid, and proceed approximately as in assay of cinchona. Dose,  $\text{M}_{\text{xv}}-60$  (1–4 Cc.).

2. *Tinctura Cinchonæ*. Tincture of Cinchona. (Syn., Tincture of Yellow Cinchona—Peruvian Bark, *Tinctura Cinchonæ Flavæ*; Fr. *Teinture de Quinquina (jaune)*; Ger. *Tinctura Chinæ, Chinatinktur*.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with glycerin 7.5 Cc., alcohol 67.5, water 25, finishing with alcohol 73 p. c., q. s. 100 Cc.; when assayed each 100 Cc. should contain 0.75 Gm. of anhydrous ether-soluble alkaloids. *Assay*: Evaporate tincture 50 Cc. to 10 Cc., and proceed approximately as in assay of the fluidextract, except multiply product by 4 instead of 20. Dose,  $\text{ʒj}-2$  (4–8 Cc.).

II. CINCHONA RUBRA (*C. succirubra*): 1. *Tinctura Cinchonæ Composita*. Compound Tincture of Cinchona. (Syn., Huxham's Tincture of Bark; Compound Tincture of Peruvian Bark; Fr. *Teinture de Quinquina composée*, *Elixir fébrifuge d'Huxam*; Ger. *Tinctura Chinæ composita*, *Zusammengesetzte Chinatinktur*.)

*Manufacture*: 10 p. c. Macerate, percolate red cinchona 10 Gm. + bitter orange-peel 8, serpentaria 2, with glycerin 7.5 Cc., alcohol 67.5, water 25, finishing with alcohol 73 p. c., q. s. 100 Cc. Dose,  $\text{ʒj}-2$  (4–8 Cc.).

III. QUININA: 1. *Oleatum Quininæ*. Oleate of Quinine. (Syn., *Chininum Oleicum*; Fr. *Oléate de Quinine*; Ger. *Chininoleat*.)

*Manufacture*: Triturate quinine (dried alkaloid) 25 Gm. in a warm mortar, with warm oleic acid 75 Gm., gradually added, stir until quinine dissolved. Used externally.

2. *Elixir Ferri, Quininæ et Strychninæ Phosphatum*,  $\frac{2}{10}$  p. c. 3. *Glyceritum Ferri, Quininæ et Strychninæ Phosphatum*, 10.4 p. c. 4. *Syrupus Ferri, Quininæ et Strychninæ Phosphatum*, 25 p. c.—2.6 p. c. 5. *Ferri et Quininæ Citras*, 11.5 p. c. 6. *Ferri et Quininæ Citras Solubilis*, 11.5 p. c.

## RUBIACEÆ.

Prep.: 1. *Vinum Ferri Amarum*, 5 p. c.

*Unoff. Preps.*: *Extract* (alcohol 75 p. c.), dose, gr. 5–15 (.3–1 Gm.). *Infusion*, 6 p. c. (+ aromatic sulphuric acid 1 p. c.), dose, 3ss–2 (15–60 Cc.). *Pilula Quininæ Sulphatis* (Br.). *Tinctura Quininæ* (Br.), 2 p. c. *Tinctura Quininæ Ammoniata* (Br.), 2 p. c., dose, 3ss–1 (2–4 Cc.). *Vinum Quininæ* (Br.), 2.25 p. c., dose, 3ss–1 (15–30 Cc.). *Decoction*, 6 p. c., dose, 3ss–2 (15–60 Cc.). *Warburg's Tincture* (*Antiperiodic Tincture*); rhubarb 4 Gm., angelica 4, elecampane 2, saffron 2, fennel 2, gentian 1, zedoary 1, cubeb 1, myrrh 1, white agaric 1, camphor 1, quinine sulphate 11, diluted alcohol q. s. 555 Cc.; to this may or may not be added extract of aloes 8 Gm., dose, 3j–4 (4–15 Cc.).

**PROPERTIES.**—Tonic, antiperiodic, febrifuge, astringent, stomachic, antiseptic, prevents fermentation and putrefaction. The S. American Indians still consider it poisonous, and always use milder remedies for fevers. The Ecuador cascarilleros believe their red bark is used only for dyeing. It is thought the Jesuits first discovered its medicinal properties, and not the natives, hence the name Jesuits' powder. They sold it for its weight in silver, grain for grain. Sir Robert Talbot cured Charles II. of tertian fever with this in 1679, and then sold the secret to Louis XIV., of France, who published it in 1681. The bark is astringent, the alkaloids are not. Small doses increase appetite, saliva, gastric juice, peristalsis, heart action, cerebral functions, excretion of waste products; moderate doses diminish amount of urea, uric and phosphoric acids, interfere with oxygen-carrying function of red and prevent migration of white corpuscles, lessen fever by destroying or rendering inert the infective agent causing it, and by diminishing metabolism in the tissue. Large doses depress heart, produce gastric irritation, eructation, chill and fever paroxysms, headache, dizziness, perspiration. Also quinine, if taken when not indicated, may produce fever, a sense of constriction about the head, ringing in the ears, vertigo, staggering, deafness, headache, delirium—*cinchonism*. Inasmuch as this will produce that which it cures, Hahnemann, it is said, was influenced by this fact, along with some others, to revive and reestablish homeopathy as based upon *similia similibus curantur*. Quinidine and cinchonidine are similar to quinine, but cinchonidine produces less marked head symptoms. Cinchonine is the weakest alkaloid, but causes much headache and muscular weakness.

**USES.**—Atonic dyspepsia, convalescence, gastric catarrh, asthma, bronchitis, amenorrhœa, enlarged spleen.

Quinine as a specific in malaria, acting as a direct poison to the *plasmodium malarie*, which, infesting the blood, cause the disease. In intermittents give gr. 10 (.6 Gm.) of sulphate in sweating stage, and same quantity 5 hours before the next paroxysm; in the intervals of paroxysms give arsenic. In remittents give gr. 20–30 (1.3–2 Gm.) at a dose, once or twice daily, until temperature reduced. In typhus and typhoid fevers, variola, pneumonia, pyæmia, septicæmia, neuralgia, scarlet fever, erysipelas, measles, skin affections, whooping-cough, hay fever, to stimulate uterine contraction in labor.



Cinchona bark itself is not much used now, because of its excessive bulkiness, and owing to its alkaloids presenting in such a concentrated form the medicinal properties without astringency.

*Administration.*—The hydrochloride, owing to its greater solubility, is the best salt of quinine for general use, the hydrobromide ranking next; the tannate and sulphate are the most insoluble and possess lower alkaloidal strength, but the latter, in spite of this, is employed mostly. The pill, capsule, or tablet disguises best the taste, but solutions are most effective, and their taste may be modified by licorice, chocolate, glycyrrhizin, yerba santa syrup or fluidextract, etc., in which condition the alkaloid should never be dissolved with acids, but simply suspended by mucilage.

FIG. 387.

*Cinchona scrobiculata* bark.

FIG. 388.

*Cinchona pubescens* bark.

*Poisoning:* Give potassium bromide and hydrobromic acid, and if associated with quinine will act as preventive; may need cardiac and respiratory stimulants. Morphine counteracts its cerebral action, atropine its nervous, cardiac, and antipyretic effects.

*Incompatibles:* Agents promoting waste: salts of mercury, copper, zinc, lead; tannin with decoction or infusion. Alkalies—alkaline carbonates, alkaline earths, and iodine preparations with the alkaloidal solutions, the latter forming insoluble compounds, and all the rest precipitating them.

*Synergists:* Constructive agents, iron, salicylic acid, arsenic, eucalyptus, phenol (carbolic acid), creosote.

*Allied Barks:*

1. *Maracaibo* or *Hard Yellow Bark* (*C. cordifolia*).—This constitutes nearly all of the wild-grown bark; contains  $2\frac{1}{2}$  p. c. of alkaloids.
2. *Pitaya Bark* (*C. pitayensis*).—Smooth, with circular scars, liber reddish cinnamon-brown, splintery, powder brownish-yellow.
3. *Cusco Bark* (*C. pubescens*).—Pale brownish-yellow to whitish, warty peri-

**RUBIACEÆ.**

derm, liber cinnamon-colored, fracture coarse-splintery; contains cusco-vatine, cusconadine, cuscamine. 4. *Carthagenæ Bark* (*C. lancifolia* and *C. cordifolia*).—Like the Cusco, only liber is reddish, fracture fibrous. 5. *Lima or Huanuco Bark* (*C. peruvia'na*, *C. nit'ida*, *C. micran'tha*).—In quills and half quills. 6. *Huamalies or Gray Bark* (*C. micran'tha*, *C. purpu'rea*, *C. glandulif'era*).—In ash-gray quills and half quills. 7. *Jean or False Loza Bark* (*C. Humboldtia'na*).—A very inferior variety.

*Spurious Cinchona Barks:*

1. *Cuprea or Copper-colored Bark* (*Remij'ia Purdiea'na*, *R. peduncula'ta*).—Colombia, Andes. Contains alkaloids 3 p. c.—quinine 2 p. c., the rest being quinidine, cinchonine, quinovin. The quinine exists as homoquinine and cupreine,  $C_{19}H_{22}N_2O_2$ ; this latter is red-brown with ferric chloride, and converted into quinine by methyl chloride.

2. Barks belonging to other genera as *Cascaril'la*, *Ladenber'gia*, *Nau'clea*, *Exostem'ma*, etc. All distinguished by *Grahe's test*: The powdered bark heated in a dry test-tube yields a tarry distillate of red color; this test applies to cuprea bark, but with these genera have no reaction. Some of these barks resemble cinchona, others do not.

*Allied Plant:*

1. *Mitchel'la re'pens*, *Partridge-berry*, *Squaw-vine*.—N. America. Creeping evergreen of the woods; leaves 12 Mm. ( $\frac{1}{2}$ ') long, ovate; flowers purplish, fruit a scarlet-red berry; contains saponin-like substance, resin, wax, gum, sugar. Tonic, astringent, diuretic; resembles chimaphila and viburnum, they all being sometimes prescribed together. Dose, 3ss–1 (2–4 Gm.).

**GAMBIR. GAMBIR.**

**Ourouparia** } An extract prepared from the leaves and  
**Gambir**, (*Hunter*) *Baillon*. } twigs.

*Habitat.* E. India Islands.

*Syn.* Catechu, U. S. P. 1890, Catechu Pallidum, Pale Catechu, Terra Japonica, Gambier; Fr. Gambir cubique; Ger. Gambir Catechu.

**Ou-rou-pa'ri-a.** Native name, fr. *Gr. oipa*, tail +, —i. e., the seed.

**Gam'bir.** Native Malayan name of the extract.

**PLANT.**—Strong shrubby climber, stem woody, often angular; leaves oblong-ovate, 7.5–10 Cm. (3–4') long, petiolate, acuminate, entire, smooth; flowers small, pinkish, in clusters, calyx and corolla 5-divided, stamens 5, ovary 2-celled; fruit 2.5 Cm. (1') long, narrow, ovoid tapering at each end, dehiscent, pericarp dry; seeds numerous, minute, pale brown, rough, tailed at each end. **EXTRACT** (gambir), in irregular masses, cakes or cubes about 25 Mm. (1') thick, reddish-brown, pale brownish-gray, or light brown, lighter internally, fracture dull-earthly, friable, crystalline, crystals acicular under microscope; inodorous, bitterish, very astringent, sweetish after-taste; free from starch. *Solvents*: alcohol dissolves 70 p. c., clear solution with hot alcohol, leaving behind only impurities—15 p. c., consisting of parenchymatic tissue and epidermal hairs (dis. from catechu, which shows woody fibres and larger pitted vessels); partly soluble in cold water, turbid solution with hot water. Dose, gr. 5–30 (.3–2 Gm.).

*Commercial.*—The extract is made by boiling young leafy shoots in water for 6 hours, with continued stirring and bruising, evaporating decoction to proper consistency, allowing to cool under constant and peculiar stirring; within half an hour the gambir suddenly contracts and thickens, possibly by the sudden crystallization of the catechuic acid. It is allowed to harden in various forms, the purest in thin cakes, flakes, small cubes. Nearly all exported in wooden cases from Singapore.

FIG. 389.

*Ourouparia Gambir*: blooming twig with the tendrils.

**CONSTITUENTS.**—Tannic acid 25–38 p. c., Catechin 20–29 p. c., ash 5–6 p. c.

**PREPARATIONS.**—1. *Tinctura Gambir Composita*. Compound Tincture of Gambir. (Syn., *Tinctura Catechu Composita*, U. S. P. 1890; Fr. *Teinture de Gambir*; Ger. *Gambirtinktur*.)

*Manufacture*: 5 p. c. Macerate 2 days, frequently agitating, gambir 5 Gm., saigon cinnamon 2.5, with diluted alcohol q. s. 100 Cc., filter. Dose, 3ss–2 (2–8 Cc.).

2. *Trochisci Gambir*. Troches of Gambir. (Syn., *Trochisci Catechu*, U. S. P. 1890; Fr. *Tablettes de Gambir*; Ger. *Gambirpastillen*.)

*Manufacture*: Rub until thoroughly mixed gambir 6 Gm., sugar 65, tragacanth 2, then form into mass with stronger orange flower water q. s. 100 troches. Dose, 1 troche occasionally.

*Unoff. Preps.*: *Infusion*. *Fluidextract*. *Pulvis Catechu Compositus*

## CAPRIFOLIACEÆ.

(Br.), 40 p. c. + kino 20, krameria 20, cinnamon 10, nutmeg 10, dose, gr. 10–45 (.6–3 Gm.).

**PROPERTIES.**—Similar to tannic acid, astringent, tonic. The darker colored product is most powerful, acting more energetically and harshly than kino.

**USES.**—Diarrhœa, leucorrhœa, gonorrhœa, cough, chronic sore throat, phthisis, bronchitis, hemorrhages, relaxed uvula, ulcerated nipples, chronic ulcers, relaxed oral mucous membrane and spongy gums (mouth-wash). In the arts for tanning, dyeing.

## 75. CAPRIFOLIACEÆ. Honeysuckle Family.

**Kap-ri-fo-li-a'se-e.** L. *Caprifoli-um* + aceæ—*caper*, a goat, + *folium*, leaf—*i. e.*, referring to the climbing and capering plant-habit, like a goat. Trees, shrubs, herbs. Distinguished by showy, sweet-scented flowers; leaves opposite, exstipulate; calyx 4–5-cleft, superior, persistent, tube coherent with 2–5-celled ovary; corolla 4–5-cleft, bearing as many stamens on its tube; regular or irregular; ovary 1–6-celled, inferior; filaments in pairs at each sinus; anthers 1-celled; fruit berry or drupe; temperate climates; emetic, purgative, astringent, diuretic, sudorific, acrid, poisonous.

Genus: 1. *Virburnum*.

## VIBURNUM OPULUS. VIBURNUM OPULUS.

*Virburnum* }  
*Opulus*, Linné. } The dried bark (of the stem).

**Habitat.** United States, in thickets; New Brunswick, far west, and south to Penn.

**Syn.** Cramp Bark, High Cranberry, Cranberry Tree, Marsh or May Rose, White Dogwood, Dog Rowan or Gaiter Tree, Gatten, Cherrywood, Rose-, Marsh-, or Water Elder, Squaw Bush, Whitten Tree, Wild Guelder Rose, Cranberry Tree Bark; Fr. Écorce d'Obier; Ger. Wasserholderrinde.

**Vi-bur'num.** L. the wayfaring tree, fr. *vico*, *viere*, to tie—*i. e.*, the pliability of its branches.

**Op'u-lus.** L. a maple—*i. e.*, its resemblance to some of the maples.

**PLANT.**—Handsome perennial shrub, 1.3–3.5 M. (4–12°) high; stem smooth, branches spreading; ribs 3–5-ribbed, strongly 3-lobed, broadly truncate at base, lobes dentate, petioles with 2 glands at apex; flowers June, 7.5–10 Cm. (3–4') broad, greenish-white peduncled cymes; fruit 12 Mm. ( $\frac{1}{2}$ ') long, red, ovoid, acrid, substituted for cranberries, whence its name. The well-known Snowball-tree, or Guelder Rose, is a cultivated variety, having entire cyme turned into showy sterile flowers. **BARK**, in somewhat transversely curved pieces, occasionally in quills, variable length, .5–2 Mm. ( $\frac{1}{80}$ – $\frac{1}{12}$ ') thick, grayish-brown, longitudinally wrinkled, with large brown lenticels and brownish black fruit-heads of a lichen, inner surface light brown, longitudinally striate, fracture uneven, fibrous, transverse section showing several bands of bast fibres; odor slight; taste somewhat astringent, bitter. **Solvents:** hot water; diluted alcohol. Dose, ʒss–2 (2–8 Gm.).

**CONSTITUENTS.**—Viburnin, Valeric (valerianic) acid, resin (brown, bitter), tannin, sugar, oxalates, citrates, malates, ash 8–9 p. c. = earthy carbonates and phosphates (calcium, magnesium, potassium).

**Viburnin.**—Bitter principle, whitish or greenish-yellow, bitter, neutral, resinous, soluble in alcohol, sparingly in water, no residue.

FIG. 390.

*Viburnum Opulus.*

**Valeric (valerianic) Acid.**— Sometimes this is called viburnic acid, both being identical in composition and properties.

**PREPARATIONS.**— 1. *Fluidextractum Viburni Opuli.* Fluidextract of *Viburnum Opulus*. (Syn., *Extractum Viburni Opuli Fluidum*, U. S. P. 1890, Fluidextract of Cramp Bark; Ger. *Flüssiges Schneeballrindenextrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 65 p. c., q. s., evaporate to 100 Cc. Dose, 3ss–2 (2–8 Cc.).

**Unoff. Preps.:** *Infusion*, 5 p. c., dose, 3j–2 (30–60 Cc.). *Decoction*, 5 p. c., dose, 3j–2 (30–60 Cc.). *Hayden's Viburnum Compound*, which

contains also *Diosco'rea villosa*, *Scutellaria lateriflora*, and aromatics.

**PROPERTIES.**—Diuretic, tonic, antispasmodic, nervine, astringent.

**USES.**—To prevent abortion, in nervous diseases of pregnancy, dysmenorrhœa, after-pains, ovarian irritation, menorrhagia, asthma, hysteria.

### VIBURNUM PRUNIFOLIUM. VIBURNUM PRUNIFOLIUM.

**Viburnum** { *prunifolium*, Linné, } The dried bark of the root.  
              { *Lentago*, Linné. }

**Habitat.** United States, New York to Florida, west to Mich., Kan., Tex.; dry soil.

**Syn.** Black Haw, Sweet Viburnum, Sheep-berry, Boots, Shoe, Stag-bush.

**Pru-ni-fo-li-um.** L. fr. *prunum*, a plum, + *folium*, a leaf, with a plum leaf—i. e., leaves resemble those of the plum.

**Len-ta'go.** L. Linnean name, possibly of Spanish origin, where first found growing.

**PLANTS.**—Tall handsome shrubs, 3–6 M. (10–20°) high; leaves 2.5–5 Cm. (1–2') long, 12–16 Mm. ( $\frac{1}{2}$ – $\frac{2}{3}$ ') wide, opposite, smooth, shining, oval, obtuse, serrate, petioles slightly margined; flowers May, perfect, white cymes, sessile; fruit oval, black drupe (berry), sweet, edible. **BARK**, in irregular or quilled pieces, about 4 Mm. ( $\frac{1}{8}$ ') thick, dingy brown, shallowly fissured, slightly scaly, inner surface rust-brown, fracture weak, short, uneven, the inner layer whitish, the middle rust-brown, the centre dark brown; groups of stone-cells readily distinguishable in transverse section; odor, slight, peculiar; taste very bitter, somewhat astringent. **Solvents:** hot water; diluted alcohol. Dose, 3ss–2 (2–8 Gm.).

**CONSTITUENTS.**—Viburnin, Valeric (valerianic) acid, resin (brown, bitter), tannin, sugar, oxalates, citrates, malates, ash 8–9 p. c.= earthy carbonates and phosphates (calcium, magnesium, potassium).

CAPRIFOLIACEÆ.

PREPARATIONS.—1. *Fluidextractum Viburni Prunifolii*. Fluid-extract of *Viburnum Prunifolium*. (Syn., *Extractum Viburni Prunifolii Fluidum*, U. S. P. 1890, Fluidextract of Black Haw Bark; Fr. *Extrait liquide de Viburne*; Ger. *Flüssiges Viburnumextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 65 p. c., q. s., evaporate to 100 Cc. Dose, ʒss–2 (2–8 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 3–10 (.2–.6 Gm.). *Infusion*, 5 p. c., dose, ʒj–2 (30–60 Cc.). *Decoction*, 5 p. c., dose, ʒj–2 (30–60 Cc.).

PROPERTIES.—Diuretic, tonic, antispasmodic, nervine, astringent.

USES.—In threatened abortion, nervous diseases of pregnancy, dysmenorrhœa, after-pains, ovarian irritation, menorrhagia, asthma, hysteria.

*Allied Plants*:

1. *Viburnum obovatum*, *Small Viburnum*, *Black Haw*.—S. United States; shrub 2.4 M. (8°) high, fruit black, leaves broadly obovate, leathery, bitter; also used as antiperiodic.

2. *Triosteum perfoliatum*, *Fever Root*, *Fever-wort*, *Horse-gentian*.—The root (rhizome), official 1820–1880. United States. Perennial herb 1–1.3 M. (3–4°) high, hirsute; leaves pubescent beneath, 15 Cm. (6') long; flowers purplish, fruit dry yellow drupe, 12 Mm. ( $\frac{1}{2}$ ') long. Root 15–20 Cm. (6–8') long, 15 Mm. ( $\frac{3}{8}$ ') thick, knotty, brownish-yellow, bitter, nauseous; contains bitter principle, starch. Used as cathartic, emetic, diuretic, substitute for ipecac; in infusion, decoction, extract. Popular with Indians for fevers, amenorrhœa. Dose, gr. 15–30 (1–2 Gm.).

3. *Sambucus canadensis*, *Sambucus*, *Elder*.—The flowers, official 1820–1900. N. America (damp places). Semi-shrubby perennial, slightly woody, 1.5–3 M. (5–10°) high; stem branching, covered with rough, pitted-gray bark, central pith large, branches smooth; fruit, ovoid drupe, 6 Mm. ( $\frac{1}{4}$ ') long, red then purplish-black. Flowers, corymbose cymes, cream-white, when dry pale brownish-yellow; odor peculiar; taste aromatic, bitter; become worm-eaten unless a preservative (sodium chloride) is added; contain volatile oil  $\frac{1}{8}$ – $\frac{1}{2}$  p. c., resin, fat, wax, mucilage, tannin. Stimulant, carminative, diaphoretic, sudorific, diuretic, alterative, flavoring. Used mostly externally in fomentation, poultice, and ointment, for rheumatism, erysipelas, abscesses, etc.; the water for cooling application to the eyes. Dose, ʒss–1 (2–4 Gm.).

4. *S. nigra*.—Europe; tree, 4.5–6 M. (15–20°) high, 10–15 Cm. (4–6') thick, compound cymes smaller than the preceding. *S. Ebulus*, *Dwarf Elder*. All parts with strong, disagreeable odor, bitterish, acrid taste, the 4-seeded fruit, resembling elderberries; laxative; *S. maderensis*, Madeira; less aromatic than *S. nigra*.

FIG. 391.



*Sambucus canadensis.*

## RECAPITULATION No. 9.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Labiatae</i> : 1. <i>Mentha Piperita</i> . 2. Peppermint.	<i>Mentha piperita</i> .	The dried leaves and tops.	Asia, Europe, N. America.	Volatile oil, resin, tannin, gum.	Spirit, <i>Oil</i> , water, spirit, pil, rhei comp., rhei and soda, mixture, menthol.	Carminative, stimulant, nerve, antispasmodic.	Flatulence, colic, nausea, diarrhoea, headache, dysmenorrhoea, rheumatism, toothache.	Grains, 15-60 (1-4 Gm.).
1. <i>Oleum Lavandulae</i> Florum. 2. Oil of Lavender Flowers.	<i>Lavandula officinalis</i> .	The volatile oil.	S. Europe.	Terpene, $C_{15}H_{24}$ , geraniol, linalool, $C_{10}H_{18}O$ .	Spirit, comp. tinct., Fowler's solution.	Stimulant, carminative, active, nerve, errhine.	Gastralgia, nausea, headache, flatulence, perfumery.	Minims, 1-5 (0.6-3 Cc.).
1. <i>Oleum Rosmarini</i> . 2. Oil of Rosemary.	<i>Rosmarinus officinalis</i> .	The volatile oil.	S. Europe, Med. Basin.	Pinene, camphor, borneol, cineol.	Soap liniment, tinct., lavender comp.	Carminative, stimulant, diuretic, diaphoretic.	Colic, nervousness, menstrual derangements, rheumatism, sprains.	1-5 (0.6-3 Cc.).
<i>Solanaceae</i> : 1. <i>Capsicum</i> . 2. <i>Capsicum</i> .	<i>Capsicum fastigiatum</i> .	The dried ripe fruit.	S. and C. America.	Capsaicin, fixed oil, volatile oil, resin, capsaicine.	Fluidextr., oleo-resin, tincture, plaster.	Stimulant, stomachic, diaphoretic, rubefacient.	Dyspepsia, colic, cholera, diphtheria, menorrhagia, rheumatism, relaxed uvula, lumbago.	1-8 (0.6-5 Gm.).
1. <i>Belladonna Folia</i> . 2. <i>Belladonna Leaves</i> .	<i>Atropa Belladonna</i> .	The dried leaves.	C. and S. Europe.	Atropine, belladonnine, hyoscyamine, scopolamine, atropamine, atrosin, malic acid, starch.	Ale. extr., plaster, ointment, tinct.	Sedative, narcotic, mydriatic, antispasmodic, anodyne.	Rheumatism, neuralgia, sciatica, cancer, meningitis, erysipelas, asthma, coughs, spasms, scarlet fever, abscesses, eczema, phthiasis.	$\frac{1}{4}$ -3 (0.6-2 Gm.).
1. <i>Belladonna Radix</i> . 2. <i>Belladonna Root</i> .		The dried root.			Fluidextr., liniment, atropine sulfate.			$\frac{1}{4}$ -2 (0.6-13 Gm.).
1. <i>Scopola</i> . 2. <i>Scopola</i> .	<i>Scopola carniolica</i> .	The dried rhizome.	C. Europe.	Hyoscyamine, atropine, scopolamine, scopoletin.	Extr., fluidextr., scopolamine, hydrobromide.	Mydriatic, analgesic, hypnotic, antiphlogistic.	Glaucoma, pyralism, hyperidrosis.	1-3 (0.6-2 Gm.).
1. <i>Hyoscyamus</i> . 2. <i>Hyoscyamus</i> .	<i>Hyoscyamus niger</i> .	The dried leaves and flowering tops.	Europe, Asia.	Hyoscyamine, hyoscine, scopolamine, choline, hyoscyapline.	Extr., fluidextr., tincture, hyoscyamine hydrobromide and sulfate, hyoscyne hydrobromide.	Anodyne, hypnotic, narcotic, mydriatic, laxative, carminative.	Mania, insomnia, insanity, coughs, colic, tremor in paralysis, bladder trouble, constipation, chorea, tetanus.	2-10 (13-6 Gm.).

1. Stramonium. 2. Stramonium.	Datura Stramonium.	The dried leaves.	Asia.	Daturine, mucilage, albumin, KNO <sub>3</sub> .	Extract, ointment, fluidextract, tincture.	Narcotic, anodyne, antispasmodic, diuretic, mydriatic.	Insanity, mania, epilepsy, asthma, whooping-cough, rheumatism, dysmenorrhoea, chorea, sprains, ulcers, hemorrhoids, eczema.	1-5 (0.6-3 Gm.).
<i>Scrophulariaceae</i> : 1. Leptandra. 2. Leptandra.	Veronica virginica. Digitalis purpurea.	The dried rhizome and roots. The dried leaves.	N. America. S. and C. Europe.	Leptandrin, resin, saponin, tannin, alkaloid (?), maninite. Digitalin, digitoflavon, resin, digitatosmin, digitalic acid, inositol, pectin.	Extr., fluidextr., pli. cath. veg. Extr., fluidextr., infusion, tinct.	Emeto-cathartic, tonic, cholagogue, alterative, sedative, narcotic, diuretic, cardiac tonic, vascular stimulant, emetic.	Indigestion, constipation.	15-60 (1-4 Gm.).
<i>Rubiaceae</i> : 1. Coffea. 2. Coffee. 1. Thea. 2. Tea.	Coffea arabica. Thea chinensis.	Caffeine, feeble basic substance (alkaloid).	Trop. Africa. S. E. Asia.	$C_8H_{10}N_4O_2 + H_2O$	Citrated caffeine, effervescent citrated caffeine.	Tonic, stimulant, nervine, anti-emetic.	Nervous headache, cholera, diarrhoea, pithisis, dropsies, gout, insomnia, fevers.	Caffeine 1-5 (0.6-3 Gm.).
1. Ipecacuanha. 2. Ipecac.	Cephaëlis : Ipecacuanha, acuminata.	The root.	Brazil, Bolivia, New Granada.	Emetine, cephaëline, psychotrine, ipecacuanhic acid, resin.	Fluidextr., syr., wine, tr. ip. et opli, pulv. ip. et opli.	Emetic, expectorant, diaphoretic, cholagogue, haemostatic.	Catarrh, spasmodic croup, asthma, pneumonia, dyspepsia, vomiting of pregnancy, cholera, ophthalmia.	1-20 (0.6-1.3 Gm.).
1. Cinchona. 2. Cinchona.	Cinchona : Ledgeriana, Calisaya, officinalis. Cinchona succubra.	The bark.	S. America, (Java, India, Ceylon).	Quinine, quinidine, cinchonine, cinchonidine, quinamine, cinchonol, quinine, quinic acid, cinchononic acid, cinchonannic acids, cinchonone-red, volatile oil.	Fluidextract, tinct. cinch. comp., alkaloids from either. Quinine, ferri et quin. cit., oleate, ell. x. glycerite, syr. ferri quin. et strych.	Tonic, antispasmodic, febrifuge, astringent.	Dyspepsia, convalescence, gastric catarrh, asthma, bronchitis, intermittent, typhoid, pneumonia, neuralgia, erysipelas.	15-60 (1-4 Gm.).
1. Gambir. 2. Gambir.	Ouroparia Gambir.	The extract from leaves and twigs.	E. India Islands.	Tannic acid, catechin.	Tinct. co., troches.	Astringent, tonic.	Diarrhoea, leucorrhoea, phthisis, bronchitis, relaxed uvula, dysentery.	5-30 (3-5 Gm.).
<i>Caprifoliaceae</i> : 1. Viburnum Opulus. 2. Viburnum Opulus.	Viburnum Opulus.	The dried bark.	United States.	Valeric (valerianic) acid, resin, iburnin, tannin, oxalates, citrates, malates.	Fluidextract.	Diuretic, tonic, antispasmodic, nervine, astringent.	Dysmenorrhoea, menorrhagia, asthma, hysteria.	30-120 (2-8 Gm.).
1. Viburnum Prunifolium. 2. Viburnum Prunifolium.	Viburnum : prunifolium, Lentago.	The dried bark of the root.						



## 76. VALERIANACEÆ. Valerian Family.

*Va-le-ri-a-na'se-e*. L. *Valerian-a* + *aceæ*, fr. *Valerianus* or *Valerius*, who first used it in medicine—*valere*, to be strong, healthful—i. e., its odor and medicinal virtues. Herbs. Distinguished by possessing a strong-scented volatile oil; leaves opposite, exstipulate; calyx superior, tube adnate to ovary; corolla mostly 5-lobed, tubular, epigynous; stamens 1–4, inserted on corolla-tube; ovary, 1 fertile cell, 2 abortive or empty; fruit dry, often pappose; temperate climates; stimulant, antispasmodic, tonic (vol. oil).

Genera: 1. *Valeriana*.

## VALERIANA. VALERIAN.

*Valeriana officinalis*, Linné. } The dried rhizome and roots.

*Habitat*. Europe, N. Asia, in moist as well as dry localities, banks of streams; naturalized in New England and New York; cultivated.

*Syn*. Wild, Great Wild, English, German, Common, Cat's, Vermont or American-English Valerian, Setwall, Vandal Root, All Heal, Radix Valerianæ Minoris; Br. Valerianæ Rhizoma; Fr. Racine de Valériane; Ger. Radix Valerianæ, Baldrian, (Wilde) Baldrianwurzel.

*Va-le-ri-a-na*. L. see etymology, above, of Valerianaceæ.

*Of-fi-ci-na-lis*. L. see etymology of (*Asagraea officinalis*, page 101.

FIG. 392.

*Valeriana officinalis*.

**PLANT.**—Large perennial herb; stem .6–1.3 M. (2–4°) high, branched at top, cylindrical, hollow, fluted and channelled, often hairy; leaves imparipinnate with long clasping petioles; leaflets 4–10 pairs, 2.5–6.5 Cm. (1–2½') long, lanceolate, dentate; flowers small, white or rose color, agreeably odorous, terminal corymbs, corolla 5-lobed, stamens 3, sessile; fruit, capsule, 4 Mm. (¼')

long, plano-convex, compressed, 4-ribbed, pale brown, 1-seeded, oblong-ovate. **RHIZOME**, 2–4 Cm. (¾–1¾') long, 1–2 Cm. (¾–4') thick, upright, subglobular or obconical, truncate at both ends, brown or yellowish-brown, internally whitish or pale brownish, with narrow circle of white wood under thin bark; roots numerous, slender, brittle, brown, with thick bark, and slender, ligneous cord; odor peculiar, stronger and more unpleasant on keeping; taste camphoraceous, somewhat bitter, *Solvents*: water; alcohol. *Dose*, gr. 15–60 (1–4 Gm.).

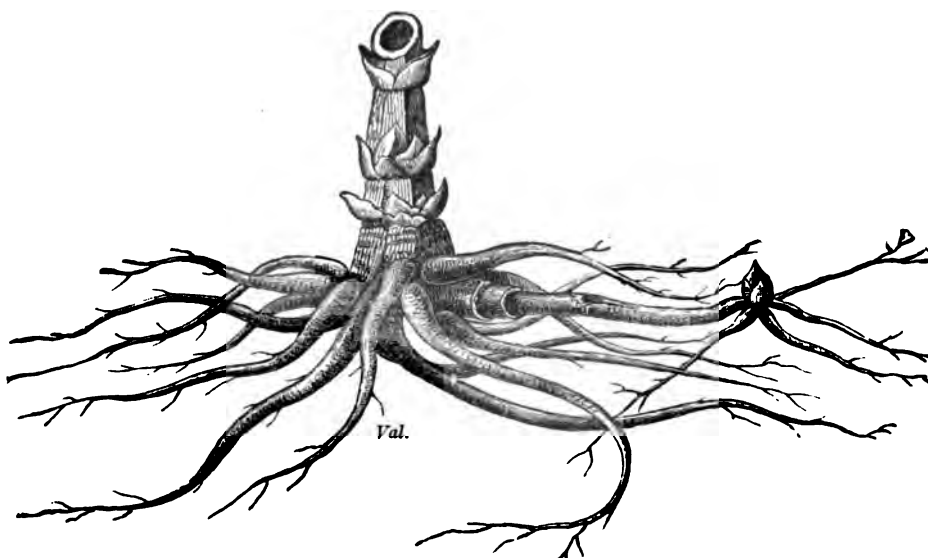
**ADULTERATIONS.**—Rhizome and roots of *V. Phu*, *V. dioica*, *Cynanchum Vincetoxicum*, *Veratrum album*, *Sium latifolium*, *Scabiosa succisa*, and *S. arvensis*, also several ranunculaceous roots.

**VALERIANACEÆ.**

*Commercial.*—Valerian flourishes equally well in damp woods, meadows, dry places, etc., but has slight peculiarities dependent upon place where growing which have led some to distinguish four varieties. These are all, however, one and the same, giving us identical constituents. Valerian is cultivated in England, Germany, Holland, United States (N. H., Vt., N. Y.), the rhizome being collected in early spring or preferably autumn from dry soil plants; the tops are cut off in spring to prevent seeding, thereby strengthening the rhizome; this latter is dug, washed, dried (whole or slit) in kilns, packed tightly, and kept dry to prevent deterioration. Very little collected from wild plants, although these are stronger and smaller.

*CONSTITUENTS.*—Volatile oil 0.5–2 p. c., Valeric (valerianic) acid, formic, acetic, malic acids, chatinine, tannin, resin, starch, mucilage, sugar.

FIG. 393.

*Valeriana officinalis*: rhizome, roots, and rootlets.

**Volatile Oil.** (*Oleum Valerianæ*, official 1880–1890.)—This is obtained by distilling with water; it is a pale green liquid, pungent valerian odor, aromatic taste, sp. gr. 0.945, yellow and viscid on exposure, levogyrate. Contains: 1, a terpene—borneene,  $C_{10}H_{16}$ , boiling at  $157^{\circ} C.$  ( $315^{\circ} F.$ ); 2, an alcohol—borneol (liquid, and solid crystalline compound),  $C_{10}H_{18}O$ , with the liquid portion chromic acid yields camphor along with formic, acetic, and valeric (valerianic) acids, these latter being likewise present in old rhizomes from slow oxidation of this  $C_{10}H_{18}O$ ; 3, an ether—borneol, or borneol oxide,  $(C_{10}H_{17})_2O$ , greenish syrupy oil, but colorless when rectified, along with formic, acetic, and valeric (valerianic) esters, which, by oxidation, form their respective acids. Recent investigators claim these components to be pinene, camphene,

borneol, and the formic, acetic, and isovaleric (valerianic) esters of borneol. Dose,  $\text{mj}-5$  (.06–3 Cc.).

**Valeric (Valerianic) Acid.**—*Acidum Valerianicum*,  $\text{C}_5\text{H}_{10}\text{O}_2$ , official 1870–1880. Not in fresh rhizome, but results from oxidation of the volatile oil on exposure; however, this is obtained mostly by oxidizing amyl alcohol with sulphuric acid and potassium dichromate. It is an oily liquid, volatile, with characteristic odor, salts sweet-tasted.

**PREPARATIONS.**—1. *Fluidextractum Valerianæ*. Fluidextract of Valerian. (Syn., *Extractum Valerianæ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Valériane*; Ger. *Flüssiges Baldrianextrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose,  $\text{Mxv}-60$  (1–4 Cc.).

2. *Tinctura Valerianæ*. Tincture of Valerian. (Syn., Fr. *Teinture de Valériane*; Ger. *Baldriantinktur*.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol 75 p. c., q. s. 100 Cc. Dose,  $3\text{ss}-2$  (2–8 Cc.).

3. *Tinctura Valerianæ Ammoniata*. Ammoniated Tincture of Valerian. (Syn., *Tinctura Valerianæ Composita*; Fr. *Teinture de Valériane ammoniacale*; Ger. *Ammoniakalische Baldriantinktur*.)

FIG. 394.



Valeriana: longitudinal and transverse sections.

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with aromatic spirit of ammonia q. s. 100 Cc. Dose,  $3\text{ss}-2$  (2–8 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 5–10 (.3–.6 Gm.). *Abstract*, dose, gr. 5–20 (.3–1.3 Gm.). *Infusion*, dose,  $\text{ʒj}-2$  (30–60 Cc.). *Water (Aqua)*. *Syrup*.

**PROPERTIES.**—Similar to other drugs having a volatile oil. Stimulant, anodyne, nervine, antispasmodic, vermifuge, no narcotic effect; increases heart action and temperature, causing exhilaration, stimulates circulation, secretion, and peristalsis of the stomach and intestines; it is eliminated by kidneys, bronchial and genito-urinary mucous membranes; if used continuously, may produce melancholia, hysteria. Large doses cause nausea, diarrhoea, urination, delirium, lessens motility, sensibility, and reflex excitability; the oil paralyzes the brain, spine, slows pulse, lowers blood-pressure.

**USES.**—Hysteria, hypochondriasis, hemicrania, nervous coughs, whooping-cough, diabetes, delirium tremens, typhoid state, dysmenorrhoea, vertigo, epilepsy, worm convulsions, flatulence, reflex neuralgia.

## CUCURBITACEÆ.

*Allied Plants:*

1. *Valeriana Phu'*.—W. Asia, S. Europe; tall perennial; rhizome (*Radix Valerianæ Majoris*) is 10–15 Cm. (4–6') long, 12 Mm. ( $\frac{1}{2}$ ') thick, annulated, brown; *V. mexicana* and *V. tolucca'na*, Mexico. All three yield valeric (valerianic) acid; odor and taste weaker than official.

2. *V. cel'tica* (*Nardus Spica celtica*).—Alps, and *Nardos'tachys Jataman'si*, *Nar'dus in'dica* (*Spica nardi*) or true spikenard, India; the former has valerian odor, the latter that of serpentaria.

## 77. CUCURBITACEÆ. Gourd Family.

Ku-ker-bi-ta'se-e. L. *Cucurbit-a* + aceæ, a gourd, fr. *curvitas*, crookedness—i. e., referring to the fruit's shape. Herbs. Distinguished by possessing acrid, bitter, purgative properties, succulent nature, prostrate or climbing, with tendrils; leaves and stem scabrous; flowers unisexual, calyx 5-toothed, tube adnate to the ovary; corolla 5's, perigynous; stamens mostly 3, usually united; ovary 1–3-celled, inferior; fruit succulent, pulpy, edible; seeds flat, many, exalbuminous; tropics; purgative (pulp), edible, poisonous.

Genera: 1. *Cucurbita*. 2. *Citrullus*. 3. *Ecballium*.

## PEPO. PEPO.

*Cucurbita* } The seed.  
*Pepo*, Linné.

*Habitat*. Tropical Asia, America; cultivated.

*Syn*. Pumpkin Seed, Pumpkin, Pompion, Cold Seeds, Semen Peponis, Semina Cucurbita; Fr. Semences de Potirons; Ger. Kürbissamen.

*Cu-cur'bi-ta*. L. see etymology, above, of Cucurbitaceæ.

*Pe'po*. L. fr. Gr. πέπων, pumpkin, old form, pompon, lit. cooked by the sun, ripe, mellow—i. e., not eaten until ripe.

**PLANT**.—Trailing annual; stem rough, hollow, hairy, 3–9 M. (10–30°) long, tendrils branched; leaves large, .25–.5 M. (10–20') long, 15–30 Cm. (6–12') wide, obtusely cordate, hispid, palmately 5-lobed, serrate, petioles 7.5–20 Cm. (3–8') long; flowers July, large, 5–12.5 Cm. (2–5') wide, yellow, bell-shaped, monœcious, axillary; anthers 3, syngenesious; fruit Oct., large, round, oblong, smooth, fleshy, yellow, furrowed, .25–.5 M. (10–20') in diameter. **SEED**, 20 Mm. ( $\frac{4}{5}$ ') long, 9 Mm. ( $\frac{3}{8}$ ') wide, 2 Mm. ( $\frac{1}{12}$ ') thick, broadly ovate, flat, somewhat biconvex, yellowish-white, nearly smooth, shallow groove parallel to and within 1 Mm. ( $\frac{1}{15}$ ') of the margin; seed-coat consisting of a white coriaceous outer layer, and a membranaceous inner layer; embryo whitish, straight, with conical hypocotyl and 2 plano-convex cotyledons; slightly odorless when contused, taste bland, oily. *Solvent*: alcohol. Dose, ʒj–2 (30–60 Gm.).

**CONSTITUENTS**.—Fixed oil 44 p. c., starch 32 p. c., acrid resin, proteids (myosin and vitellin), sugar, ash 3–4 p. c.

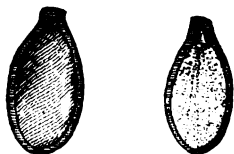
Some claim an alkaloid, cucurbitine, is present and active, but probably the resin residing in the tegmen or embryo is the active principle, although the oil has been claimed to possess (ʒiv; 15 Cc.) the medicinal power of the drug, a fact possibly due to the oil containing some resin.

**Fixed Oil.**—This consists of the glycerides of oleic, myristic and palmitic acids, and is removed by benzin, after which may treat seeds with alcohol, ether, or chloroform, to remove greenish-brown soft resin, which is acrid, bitter in taste; most of this oil can be expressed. The seed-infusion saturated with sodium chloride precipitates myosin, and when  $\text{CO}_2$  is added vitellin separates, which behaves like egg-yolk (due to its contained vitellin). The protein is possibly its emulsifying principle.



Cucurbita Pepo.

FIG. 396.



Pumpkin seed: entire and longitudinally divided, showing embryo.

**PREPARATIONS.**—(Unoff.) *Fluidextract*, dose,  $\mathfrak{zss}$ –1 (15–60 Cc.). *Emulsion* ( $\mathfrak{z}$ ij–4; 60–120 Gm. fresh seeds, deprived of testa, should be beaten into a paste with sugar + water or milk  $\text{Oj}$ ; .5 L.), dose,  $\mathfrak{z}$ v (150 Cc.) at 2-hour intervals beginning at 10 o'clock A. M.

Patients should remain quietly in bed all day. On the night before, and also before breakfast, give saline purgative to remove mucus, and about 3–4 hours after the pint (.5 L.) has been taken administer castor oil  $\mathfrak{z}$ j–2 (30–60 Cc.). Should fast the day previous to taking the medicine.

**PROPERTIES AND USES.**—Tæniifuge, vermifuge, valuable because of its freedom from taste and harshness of action, but has the disadvantage of uncertainty. Same treatment applies to tape- and lumbricoid worms.

#### Allied Plant:

1. *Citrullus Citrullus* (*Cucurbita (Cu'cumis) Citrullus*), *Watermelon Seed*.—S. Asia, cultivated. Fruit edible, very large; seed flat, ovate, 12 Mm. ( $\frac{1}{2}$ ') long, blackish, marbled, or orange-brown, ungrooved, blunt on the edge, otherwise like pumpkin seed. Contain fixed oil 30 p. c., proteids; diuretic, tæniifuge, anthelmintic. Dose,  $\mathfrak{z}$ ij–16 (8–60 Gm.).

### COLOCYNTHIS. COLOCYNTH.

**Citrullus**  
**Colocynthis**, (Linné) Schrader. } The peeled dried fruit.

**Habitat.** S. and W. Asia, N. and S. Africa, in arid places, deserts. (Arabia, Syria, Egypt, Morocco, Cape of Good Hope, Greece, Spain, Japan; cultivated.)

**Syn.** Bitter Apple, Cucumber, or Gourd, Colocynth Apple or Fruit. Br. Colocynthis Pulpa, Colocynth Pulp, Poma Colocynthis; Fr. Coloquinte; Ger. Fructus Colocynthis, Koloquinthen, Coloquinthenapfel.

**Citrullus.** L. *citrus*, an orange, Gr. *κίτρον*, citron, Ar. origin—i. e., named after color of the fruit when cut—orange-red.

**Col-o-cyn'this.** L. fr. Gr. *κολοκύνθις*, the classic name of the plant.

**PLANT.**—Perennial, resembling very much the watermelon (*C. Citrullus*, an annual with larger, smoothish leaves, and larger, sweeter

**CUCURBITACEÆ.**

fruit); stem herbaceous, angular, hispid; leaves many-lobed, hairy, 2.5–10 Cm. (1–4') long, subpalmately cleft on long hispid petioles; tendrils, with which the vine climbs, short, branching; flowers large, monœcious, both kinds being similar, solitary, yellow. FRUIT, globular, 5–10 Cm. (2–4') thick, size of a small orange, smooth, greenish, mottled, when peeled whitish-yellow, 1-celled (though apparently 6-

FIG. 397.

*Citrullus Colocynthis.*

celled, light, inside soft, spongy when dry breaking longitudinally into 3 wedge-shaped carpels, each having near the pericarp numerous ovoid, compressed, whitish or light brown seeds; odor slight; taste intensely bitter. The pulp, constituting 30–35 p. c., should alone be used, the seeds being separated and rejected, as they possess very little activity, although being slightly bitter and containing 17 p. c. of fixed oil.

When seeds deprived of testa the remaining kernel is one-half oil, owing to which property they are used in Africa for food, bread, etc. *Solvents*: alcohol; diluted alcohol; water. Dose, gr. 2–10 (.13–.6 Gm.); laxative, gr. 2–5 (.13–.3 Gm.); drastic purgative, gr. 5–10 (.3–.6 Gm.), repeated in 8–12 hours if necessary.

*Commercial*.—Colocynth is a very old medicine, having been cultivated in gardens of England since 1551. Two varieties are recognized: 1. *Peeled, Turkey*. 2. *Unpeeled, Mogador*. The former is the smaller and best, being usually from the maritime plain between the mountains of Palestine and the Mediterranean; chiefly shipped from Jaffa or Trieste, that from Spain being smaller with less pulp; the latter (unpeeled) has smooth brownish-yellow exterior. The fruit is gathered in autumn when turning yellow, peeled (or this, if to be done, may be deferred until after drying) and dried quickly by sun or fire; not used or known by native physicians as a cathartic, but only to protect from moths.

**CONSTITUENTS**.—Pulp 30–35 p. c., Seed 65–70 p. c. Pulp contains colocynthin 2 p. c., Colocynthitin, pectin, gum, no starch, ash 9–14 p. c.; Seeds have bitter principle, fixed oil 17 p. c., albuminoids 6 p. c., ash 2–4 p. c.

**Colocynthin**,  $C_{36}H_{81}O_{23}$ .—The chief cathartic principle: an amorphous glucoside (bitter principle), obtained by exhausting with water the alcoholic extract, precipitating filtrate with lead acetate and subacetate; the yellow filtered liquid is treated with  $H_2S$  to remove lead, filtered, then precipitated with tannin. This tannate of colocynthin is dissolved in alcohol, the tannin thrown down by lead subacetate, filtered liquid digested with animal charcoal, filtered, evaporated. It is a yellow powder, soluble in water, alcohol, boiled with diluted acids splits into sugar and resinous colocynthein. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.)—hypodermically, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.01–.02 Gm.), by which method it is painful, and should be associated with cocaine. The “Eclectic” resinoid, *colocynthin*. Dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.).

**Colocynthitin (citrullin)**.—A resin left after treating alcoholic extract with cold water in preparing colocynthin, soluble in alcohol, ether, hot water in tasteless white microscopic prisms.

**PREPARATIONS**.—1. *Extractum Colocynthidis*. Extract of Colocynth. (Syn., Extractum Colocynthidis Alcoholicum; Fr. Extrait de Coloquinte; Ger. Koloquinthenextrakt.)

*Manufacture*: Macerate 100 Gm. with diluted alcohol 350 Cc. for 4 days, express, strain and reserve liquid; percolate residue with diluted alcohol until percolate mixed with reserved liquid measures 500 Cc., distil, evaporate, reduce to powder; yield 14 p. c.; from pulp alone 30–40 p. c.; seed alone 5 p. c. Should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

Prep.: 1. *Extractum Colocynthidis Compositum*. Compound Extract of Colocynth. (Syn., Fr. Extrait de Coloquinte composé; Ger. Zusammengesetztes Koloquinthenextrakt.)

*Manufacture*: Melt purified aloes 50 Gm., add alcohol 10 Cc., soap 14 Gm., extract of colocynth 16, resin of scammony 14,

## CUCURBITACEÆ.

heat until homogeneous, withdraw heat, incorporate cardamom 6, cool, reduce to fine powder. Should be kept in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

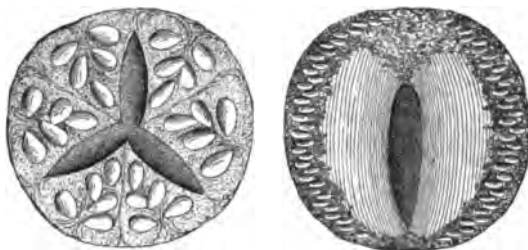
Preps.: 1. *Pilulæ Catharticæ Composite*. Compound Cathartic Pills. (Syn., Antibilious Pills; Fr. *Pilules cathartiques composées*; Ger. *Abführpillen*.)

*Manufacture*: Compound extract of colocynth 8 Gm., mild mercurous chloride 6, resin of jalap 2, gamboge 1.5, diluted alcohol q. s. for 100 pills. Dose, 1–3 pills.

2. *Pilulæ Catharticæ Vegetabiles*. Vegetable Cathartic Pills. (Syn., Fr. *Pilules cathartiques végétales*; Ger. *Vegetabilische Abführpillen*.)

*Manufacture*: Compound extract of colocynth 6 Gm., extract of hyoscyamus 3, resin of jalap 2, extract of leptandra 1.5, resin of podophyllum 1.5, oil of peppermint .8 Cc., diluted alcohol q. s. for 100 pills. Dose, 1–3 pills.

FIG. 398.



Peeled colocynth: transverse and longitudinal sections.

*Unoff. Preps.*: *Pilula Colocynthis Composita* (Br.), 20 p. c., barb. aloes 40, resin of scammony 40, potassium sulphate 5, oil of cloves 5, water q. s., dose, gr. 4–8 (.26–.5 Gm.). *Pilula Colocynthis et Hyoscyami* (Br.), compd. pill of colocynth, 66 p. c., ext. of hyoscyamus 33 p. c., dose, gr. 4–8 (.26–.5 Gm.). *Tincture*, 10 p. c. (alcohol), dose, 3ss–1 (2–4 Cc.). *Fluidextract*, dose, Mij–10 (.13–.6 Cc.).

**PROPERTIES.**—Drastic and hydragogue cathartic, hepatic stimulant, diuretic; small doses bitter, stomachic; large doses emetic, irritant poison, causing violent griping, dangerous bowel inflammation—gr. 90 (6 Gm.) have killed. It is very harsh and seldom used alone.

**USES.**—The Greeks and Arabians were unacquainted with its drastic effect, but prescribed it for its other properties. Now used as an evacuant, dropsy, melancholia, coma, apoplexy, paralysis, but never in pregnancy, nor where gastric or intestinal inflammation is present.

*Poisoning*: Same as for aloes, etc. Evacuate stomach, give demulcents, opium, stimulants.

*Allied Plants*:

1. *Luffa Luffa* (*ægypti'aca*), Egypt, and *L. opercula'ta*, Brazil, *Vegetable Sponge*, *Wash-rag Sponge*, *Gourd Towel*. 2. *Cucumis myrio-*



*car'pus*, S. Africa. These produce analogous fruits, which have similar action to colocynth, while the derma of *Luffa* serves as sponge. 3. *Momor'dica Balsam'ina*, *Balsam Apple*, E. India. Climbing plant, also cultivated in gardens throughout the United States for its yellow cucumber-like fruit. This is soaked in whisky and used domestically as a vulnerary.

### ECBALLIUM. SQUIRTING CUCUMBER.

**Elaterium.** *Elaterin*,  $C_{20}H_{28}O_5$ , *official*.

**Ecballium**  
**Elaterium**, (*Linné*) *A. Richard*. { A neutral principle from Elaterium, a substance deposited by the juice of this fruit.

*Habitat.* W. Asia, N. Africa, S. Europe; cultivated.

*Syn.* Squirting or Wild Cucumber, Wild Balsam Apple; Fr. *Concombre sauvage*, *Elatérine*, *Elatine*; Ger. *Eeelsgurke*, *Springgurke*, *Elaterin*.

**Ec-bal'li-um.** L. fr. Gr. *ἐκ*, out, + *βάλλειν*, to throw—i. e., the fruit expelling its contents when fully ripe.

**El-a-te'ri-um.** L. fr. Gr. *ἐλατήριον*, driving out, purging—i. e., its medicinal property. **El-a-te-ri'num**, **E-lat'er-in**,—both are simply derivative names.

**PLANT.**—Common perennial weed; stem trailing, succulent, bristly, .6–1.3 M. (2–4°) long; leaves cordate, 7.5–12.5 Cm. (3–5') long, lobed, hispid, pale green; flowers monœcious, yellow; fruit 5 Cm. (2') long, 2.5 Cm. (1') thick, oblong, pale yellowish-green, beset with

fleshy prickles, 3-celled, containing bitter, watery, mucilaginous juice in which are many light brown seeds. When fruit ripe, it becomes yellow and falls to the ground from its attachment; at the instant of separation, through the socket (peduncle orifice) made by falling from the stem the entire contents are expelled violently, hence called squirting cucumber. This is due to osmosis from pericarp to central pulp, causing engorgement, hence tension and rupture at weakest point. For preparing Elaterium, the fruit and stalk should be collected just before ripe, cut lengthwise, lightly pressed (the best without pressure), juice strained, set aside to deposit, and the sediment put upon porous tiles to dry by gentle heat. Should not be exposed to sun. Forty cucumbers without pressure yield 6 gr. (.4 Gm.), and



FIG. 399.

*Ecballium Elaterium.*

40 pounds (18 Kg.) yield only 240 gr. (15.5 Gm.). Elaterium occurs in grayish fragments or scales, odor tea-like, taste bitter, acrid. Should

**CUCURBITACEÆ.**

not effervesce with hydrochloric acid. Dr. Clutterbuck's is considered best.

**ADULTERATIONS.**—**ELATERIUM**: Starch, calcium carbonate, various minerals colored green. Owing to this adulteration and the irregular treatment in collecting and curing, it becomes a very uncertain product, hence the official Elaterin is much to be preferred, which as a rule is pure.

**CONSTITUENTS.**—Elaterin 44 p. c., green resin 17 p. c., starch 6 p. c.; prophetin, ecballin, hydroelaterin, elaterid.

**Elaterinum. Elaterin.**—Obtained by exhausting elaterium with hot alcohol and precipitating with water, or treating with hot chloroform and precipitating with ether, washing with ether and recrystallizing from alcohol or chloroform. It occurs in white hexagonal scales or prismatic crystals, odorless, slightly acid, bitter taste, permanent, without water of crystallization, soluble in 22 parts chloroform, 262 alcohol, 272 benzene, 318 ether, insoluble in water, no residue; with sulphuric acid turns yellow then scarlet, + formaldehyde brown, + potassium dichromate olive-green, becoming darker. *Tests*: 1. Alcoholic solution should not be precipitated by tannic acid T. S., or mercuric chloride T. S., or platinic chloride T. S. (abs. of and dif. from alkaloids). Dose, gr.  $\frac{1}{20}$ — $\frac{1}{10}$  (.003–.006 Gm.).

FIG. 400.

*Bryonia dioica.*

**PREPARATIONS.**—1. *Trituratio Elaterini*. Trituration of Elaterin. (Syn., Fr. Trituration d'Elatérine; Ger. Elaterintrituratur.)

*Manufacture*: 10 p. c. Triturate 10 Gm. with sugar of milk 90. Dose, gr.  $\frac{1}{2}$ — $\frac{3}{4}$  (.03–.05 Gm.).

*Unoff. Preps.*: *Pulvis Elaterini Compositus* (Br.), 2.5 p. c., dose, gr. 1—4 (.06–.26 Gm.). *Elaterium*, dose, gr.  $\frac{1}{8}$ — $\frac{1}{4}$  (.008–.016 Gm.). *Solution of Elaterium*,  $\frac{1}{4}$  p. c. in alcohol +  $\frac{1}{2}$  p. c. nitric acid, dose, ℥<sub>xxx</sub> (2 Cc.).

**PROPERTIES.**—Hydragogue cathartic (most powerful known), pro-

ducing profuse watery evacuations with griping and much prostration; large doses nauseate, vomit, inflame stomach and bowels, increase flow of urine, and may kill. Does not vomit nor purge dogs, rabbits, but kills them by convulsions. Those working in it often have ulcerated fingers, eyes, etc.

**Uses.**—The fruit was employed by the ancients, being recommended by Dioscorides in mania, melancholia. Sydenham used it in dropsy, but it fell into disfavor through its severity, until brought forward again by Dr. Ferriar. Useful in dropsy, Bright's disease with dropsy, brain and lung congestion, uræmia, but never in heart disease.

**Poisoning:** Same as for aloes, etc. Evacuate stomach, give demulcents, opium, stimulants.

*Allied Plants:*

1. *Bryo'nia al'ba* and *B. dioi'ca*, *Bryonia*, *Bryony*.—The dried root, collected in the spring, official 1880–1900. C. and S. Europe. Perennial climbers, the former monœcious, the latter diœcious; leaves heart-shaped, 5-lobed; flowers small, greenish-white or yellowish; fruit, berries, size of a pea, the former black, the latter red (hence names black and red bryony). Root, spindle-shaped, .3–.6 M. (1–2°) long, lactescent, fleshy, usually in transverse sections 3 Mm. ( $\frac{1}{8}$ ') thick, 5 Cm. (2') broad, yellowish-white, cambium line brown, medullary rays broad, many wood-bundles, fracture short; inodorous, bitter; contains bryonin, bryonidin, bryoresin, starch, gum, fat, malates; solvents: alcohol, hot water. Hydragogue cathartic, emmenagogue, vesicant, emetic (large doses). Used in dropsy, epilepsy, hysteria, bronchitis, whooping-cough, rheumatism, swollen glands, scabies; large doses poisonous. Dose, gr. 10–60 (.6–4 Gm.); tincture, 10 p. c., 3j–2 (4–8 Cc.); mother-tincture (homeopathic), Mv–40 (.3–2.6 Cc.); infusion, 5 p. c., 3j–2 (30–60 Cc.); fluidextract, Mx–60 (.6–4 Cc.); bryonin, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.01–.02 Gm.).

2. *Cayapo'nia america'na* (*Bryonia americana*).—W. Indies. 3. *Bryonia Kedros'tis na'na* (*africa'na*). S. Africa. Both in their respective countries are used like bryonia, especially for dropsy. 4. *B. epi-gæ'a*. India. Used natively as an alterative in syphilis, and as a remedy for snake-bites.

## 78. CAMPANULACEÆ. Bell-flower Family.

Kam-pan-u-la'se-e. L. *Campanul-a* + *acæe*, dim. of *campana*, a bell—i. e., from the resemblance of the corolla. Herbs, shrubs. Distinguished by alternate exstipulate leaves; acrid and usually milky juice; solitary perfect flowers, calyx 5-lobed, corolla gamopetalous, campanulate or rotate, limb 5-lobed, stamens separate or syngenesious; ovary 2–5-celled, inferior; fruit capsule or berry; temperate climates; emetic, diaphoretic, narcotic.

Genus: 1. *Lobelia*.

## CAMPANULACEÆ.

## LOBELIA. LOBELIA.

**Lobelia** } The dried leaves and tops, collected after a portion of  
**inflata, Linné.** } the capsules have become inflated.

*Habitat.* N. America (Canada, United States), in fields and open places.

*Syn.* Green, Brown or Bladder-podded Lobelia, Wild or Indian Tobacco, Emetic Herb or Weed, Asthma or Puke Weed, Eye-bright, Gag Root, Vomit Wort, Low Belia; Fr. (Herbe de) Lobélie enflée; Ger. Herba Lobeliæ, Lobelienkraut.

**Lo-be-li-a.** L. after Matthias de Lobel, Flemish botanist, physician, and author of several botanical works (1538-1616), native of Lille, became physician and botanist to James I., died in London.

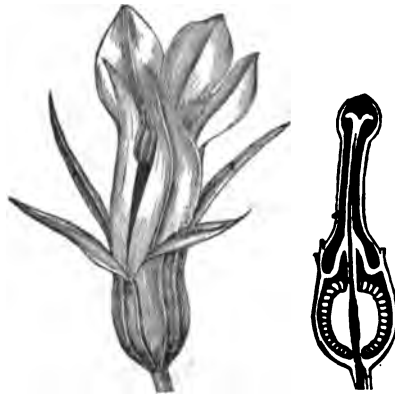
**In-fla'ta.** L. *inflatus*, inflated, swollen—i. e., seeds are borne in egg-shaped inflated pod.

**PLANT.**—Annual herb, .3-.6 M. (1-2°) high, erect, paniculately branched, pubescent, with spreading hairs; root fibrous. **LEAVES**, alternate, 4-9 Cm. (1½-3½') long, lower short-petioled, upper sessile, ovate or oblong, irregularly serrate-denticulate, divisions with yellowish-brown, gland-like apex, pale green, pubescent; stems coarsely angled, often purplish, hairy, terminating in long racemes of small short-pedicelled flowers, July-Sept., having adherent 5-toothed calyx, small tubular corolla, cleft to base on upper side, the one-sided limb 5-lobed, and pale blue in fresh state, 5 stamens united; capsule inflated, 2-celled, containing many minute brownish, ellipsoidal, coarsely reticulate seeds; odor slight, irritating; taste strongly acrid. Loses upon drying 75 p. c. *Solvents*: diluted

FIG. 401.

*Lobelia inflata.*

FIG. 402.

*Lobelia* flower and section: magnified 5 diam.

alcohol; boiling water. Dose, expectorant, gr. 1-5 (.06-.3 Gm.); emetic, gr. 10-20 (.6-1.3 Gm.).

*Commercial.*—Lobelia was popular with the North American Indians,

but Dr. Cutler, of Massachusetts, introduced it into our medical practice. It should be collected Aug.-Sept., carefully dried, and sold loosely or in various-sized compressed packages; powder keeps well.

**CONSTITUENTS.**—Lobeline, Lobelacrin, Lobelic acid, Inflatin, a second alkaloid (?), resin, wax, volatile oil, gum.

**Lobeline.**—Obtained by evaporating to syrup the acetic-alcoholic tincture (preferably of seeds), triturating this with magnesium oxide in excess, agitating filtrate with ether, evaporating, getting impure alkaloid. It is a yellow, aromatic liquid, acrid taste, convertible into amorphous powder and non-crystalline salts (hydrobromide, sulphate, etc.), soluble in water. Dose (sulphate), gr.  $\frac{1}{4}$ –1 (.01–.06 Gm.).

**Lobelacrin.**—Obtained by concentrating tincture in the presence of charcoal, washing with water, exhausting with boiling alcohol; it is the acrid principle—possibly lobelate of lobeline, brown, soluble in ether or chloroform.

**Lobelic Acid.**—Obtained by precipitating decoction of leaves with copper sulphate, and decomposing with hydrogen sulphide; it is colored olive-brown by ferric salts.

**Inflatin.**—Neutral principle (wax), tasteless crystals, no medicinal value.

**PREPARATIONS.**—1. *Fluidextractum Lobeliæ*. Fluidextract of Lobelia. (Syn., *Extractum Lobeliæ Fluidum*, U. S. P. 1890; Fr. *Extrait liquide de Lobélie enflée*; Ger. *Flüssiges Lobelienkraut-extrakt*.)

*Manufacture*: Macerate, percolate 100 Gm. with water 75 Cc. + acetic acid 25, finishing with same menstruum q. s., evaporate to 100 Cc. Dose,  $\mathfrak{m}\text{j}$ –5–20 (.06–.3–1.3 Cc.).

• 2. *Tinctura Lobeliæ*. Tincture of Lobelia. (Syn., Fr. *Teinture de Lobélie enflée*; Ger. *Lobelientinktur*.)

*Manufacture*: 10 p. c. Macerate, percolate 10 Gm. with diluted alcohol q. s. 100 Cc. Dose,  $\mathfrak{m}\text{v}$ –30–60 (.3–2–4 Cc.).

*Unoff. Preps.*: *Tinctura Lobeliæ Ætherea* (Br.), 20 p. c. (spirit of ether), dose,  $\mathfrak{m}\text{v}$ –15 (.3–1 Cc.). *Extract*, dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.). *Infusion*, dose,  $\mathfrak{z}\text{ss}$ –1 (15–30 Cc.). *Acetum*, 10 p. c., dose,  $\mathfrak{m}\text{v}$ –60 (.3–4 Cc.). The “Eclectic” *lobelin*, made in the usual way, is an impure resinoid, dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

**PROPERTIES.**—Expectorant, emetic, nervine, purgative, narcotic, diuretic, diaphoretic; similar to ipecac, but causes more distressing nausea and intense prostration. It paralyzes the motor nerves, vasomotor centre, and peripheral vagi. Leaves chewed a short while cause giddiness, headache, tremors, nausea, vomiting; full doses give speedy and severe vomiting, general relaxation, cold skin with sweating; resembles tobacco, is dangerous, having caused many deaths.

**USES.**—Spasmodic asthma, catarrh, bronchial spasms, whooping-cough, in enema for intussusception, strangulated hernia, constipation; externally for poison-oak eczema. Should not be given as an emetic, and it is too depressing for children.

**Poisoning**: Have burning pain in fauces, œsophagus, motor weak-

## CICHORIACEÆ.

ness, great depression, feeble pulse, low temperature, anxious, livid countenance, contracted pupils, vertigo, tremors, cold sweat, pale skin, sometimes violent purging, collapse, stupor, coma, death from respiratory failure. Place in recumbent position, empty stomach if vomiting has not been free, give tannin, cardiac and respiratory stimulants, strychnine, picrotoxin, thebaine, alcohol, digitalis, atropine or belladonna, digitalis, morphine, artificial heat, ergot, castor oil.

*Incompatibles*: Strychnine, picrotoxin; caustic alkalies decompose lobeline, making preparations inert.

*Synergists*: Emetics, motor depressants.

*Allied Plants*:

1. *Lobelia syphilitica*, *Great Lobelia*.—Stem .6–1 M. (2–3°) high; flowers large, 2.5 Cm. (1') long, beautiful blue; diaphoretic. Used by the aborigines for syphilis.

2. *L. cardinalis*, *Cardinal-flower*.—Stem .6–1.3 M. (2–4°) high; flowers large, showy, intense cardinal or scarlet-red. Used by Indians as anthelmintic; similar to *L. syphilitica*, but milder.

## 79. CICHORIACEÆ. Chicory Family.

Si-ko-ri-a'se-e. *L. Cichori-um* + aceæ, Gr. *κίχῳριον*, *κίχῳρα*, fr. Egypt. *chikouryek*, chichory, chicory, succory—i. e., the original Arabic name of the characteristic plant. Herba. Distinguished by alternate or basal leaves; milky acrid or bitter juice; flowers all alike, perfect, calyx-tube adnate to ovary, corolla gamopetalous, limb 5-toothed, anthers syngenesious; ovary 1-celled; fruit achene; universal; diuretic, tonic, aperient, deobstruent.

Genera: 1. *Taraxacum*. 2. *Lactuca*.

## TARAXACUM. TARAXACUM.

*Taraxacum officinale*, Weber. } The dried root, collected in  
(*Taraxacum Taraxacum*, (Linné) Karsten.) } autumn.

*Habitat*. Europe (naturalized in N. America); grassy places, roadsides, pastures, fields.

*Syn*. Dandelion, Lion's Tooth, White (Wild) Endive, Swine Snout, Cankerwort, Irish Daisy, Milk Gowan, Priest's Crown, Puff Ball; Br. *Taraxaci Radix*; Fr. *Pissenlit*, *Dent de Lion*, *Couronne de moine*; Ger. *Radix Taraxaci cum Herba*, *Löwenzahn*, *Pfaffenröhrchen*.

*Ta-rax'a-cum*. L. fr. Gr. *ταράσσω*, *τάρακτικός*, to move, disturbing—i. e., its medicinal properties; name assigned the plant by medieval pharmacists.

*Of-fi-ci-na'le*. L. see etymology of (*Rheum*) *officinale*, page 177.

*Dan'de-li'on*. E. fr. L. *dens*, tooth, + *leo*, *leonis*, of the lion—i. e., leaves shape of the lion's tooth (runcinate).

PLANT.—Perennial herb, acaulescent; leaves radical, direct from root-crown, 15–22.5 Cm. (6–9') long, 5–7.5 Cm. (2–3') wide, toothed (runcinate), teeth bent backward, 5–6 on a side, sessile, glabrous, bright green; flowers terminal upon hollow scapes, 15–20 Cm. (6–8') high, arising from midst of leaves, golden-yellow, 4 Cm. (1½') broad, close at night; fruit achene, compressed, oblong-ovate, terminating in silky,

hairy, spreading pappus, elevated on a pale greenish-white stalk, so that when mature the seed attached to this pappus is enabled to be wafted by the wind, to settle down at some distance and there propagate its kind. Root, cylindraceous, tapering very gradually, of variable length (5–15 Cm.; 2–6'), 1–2 Cm. ( $\frac{2}{3}$ – $\frac{4}{5}$ ') thick above, crowned with several short, thickish heads, usually simple or somewhat branched, the branches closely parallel, blackish-brown, longitudinally wrinkled, fracture short, showing a yellowish, porous central axis, surrounded by a thick, whitish bark, containing numerous milk vessels arranged in concentric circles; inodorous, bitter; should be free from *Cichorium Intybus* root, which closely resembles it, but is usually paler, with milk-vessels in radiating lines. *Solvents*: diluted alcohol; boiling water. Dose, 3ss–2 (2–8 Gm.).

*Commercial*.—*Taraxacum* grows alike in dry and in damp places, is a universal plant, and was known to the Arabians as a blood-purifier. The root collected in spring loses in drying 80–85 p. c., if in autumn only 70–75 p. c.; it is sweet after frost and early spring, owing to uncrystallizable sugar 17 p. c. and levulin 18.7 p. c., but these by approaching fall go into or are replaced by inulin, so that an extract made from the spring collection is sweetish-bitter, and does not become opaque. During spring and summer milk-juice thickens, bitterness increases, and by autumn is considered generally most

FIG. 403.

*Taraxacum officinale*.

FIG. 404.

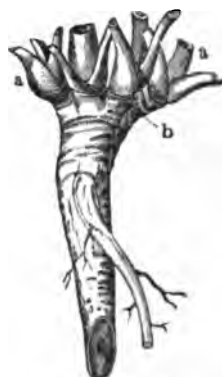
*Taraxacum officinale*: rhizome revealing at head the remnants of flower stalks and leaf stalks.

FIG. 405.

*Taraxacum*: transverse section of root.

efficient; that collected June–Aug. may also be as valuable, but is not uniform, hence unreliable; that of Feb.–March gives an extract reliable and clear from its containing so little inulin (1.74 p. c.), and is by some considered the best, whereas that of Oct. is possibly more reliable, but opaque from excessive amount of inulin (24 p. c.). Dried root is

## CICHORIACEÆ.

attacked often by maggots, consequently should not be kept longer than a year.

**CONSTITUENTS.**—Milk-juice (containing taraxacin, taraxacerin, 2 resins, and glutinous body), reducing sugars, levulin, inulin 24 p. c., pectin, ash 5–7 p. c.

**Taraxacin.**—Obtained by treating milk-juice with boiling water, evaporating; it is a crystalline bitter principle, non-volatile, acrid, soluble in hot water, alcohol, and ether.

**Taraxacerin,  $C_8H_{16}O$ .**—Obtained by treating milk-juice with hot alcohol; it is crystallizable, insoluble in water, soluble in alcohol. Old extracts may contain calcium lactate crystals, the lactic acid being produced from inosite, which is present in the leaves and stalks, but not believed to be in the root.

**PREPARATIONS.**—1. *Extractum Taraxaci*. Extract of Taraxacum. (Syn., Extract of Dandelion; Fr. Extrait (de Pissenlit) de Dent de Lion; Ger. Löwenzahnextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with alcohol 12.5 p. c., q. s., evaporate to pilular consistence. Dose, gr. 5–30 (.3–2 Gm.).

2. *Fluidextractum Taraxaci*. Fluidextract of Taraxacum. (Syn., Extractum Taraxaci Fluidum, U. S. P. 1890; Br. Extractum Taraxaci Liquidum; Fr. Extrait liquide de Pissenlit; Ger. Flüssiges Löwenzahnextrakt.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 95 Cc., add solution of sodium hydroxide 5 Cc. Dose, 3ss–2 (2–8 Cc.).

**Unoff. Preps.:** *Succus Taraxaci* (Br.), expressed juice 3 parts + alcohol 1, dose, ʒj–2 (4–8 Cc.).

**Decoction,** 5 p. c., dose, ʒj–2 (30–60 Cc.).

**PROPERTIES.**—Diuretic, tonic, stomachic, aperient, deobstruent.

**USES.**—Congestion and inflammation of liver and spleen, dyspepsia, constipation, con-

FIG. 406.

*Cichorium Intybus*.

FIG. 407.



Cichorium: transverse section.

sumption, skin affections, dropsies, substitute for coffee. Fresh leaves sometimes used as salad.

*Allied Plants:*

1. *Cichorium In'tybus*, *Chicory*.—Europe, naturalized in United States. Root with laticiferous vessels radiate, also is whiter, more



woody, and has thinner bark than taraxacum. July collection contains 36 p. c. of inulin, bitter principle, etc., and has properties similar to taraxacum root, with which it often is mixed as an adulterant. Roasted root is used frequently to adulterate coffee. 2. *C. Endiv'ia*, *Endive*.—Levant; cultivated for its bitter leaves.

## LACTUCARIUM. LACTUCARIUM.

**Lactuca virosa**, Linné. } The concrete milk-juice.

*Habitat.* C. and S. Europe, W. Siberia, naturalized in New England; cultivated.

*Syn.* Acrid Lettuce, Wild Lettuce, German Lactucarium, Strong-scented Lettuce, Prickly Lettuce, Green Endive; Fr. Laitue vireuse, Lactucarium; Ger. Giftlattichsaft.

**Lac-tu'ca.** *L. lac, lactis*, milk—i. e., from the milky juice which exudes when plant is punctured or broken.

**Vi-ro'sa.** *L. virosus*, poisoning—i. e., its medicinal properties or odor opium-like.

**Lac-tu-ca'ri-um.** *L. lactuca*, lettuce, of or belonging to lettuce.

**PLANT.**—Biennial herb with brown tap-root; stem .6–2 M. (2–6°) high, erect, glabrous, prickly, pale glaucous-green, often purple-spotted; leaves runcinate—radical .4–.5 M. (16–18') long, obovate, entire—cauline smaller, few, sessile, spinose apex and margin; base auriculate, pale glaucous-green, midrib spiny beneath; flowers Aug., pale yellow, 12–25 Mm. ( $\frac{1}{2}$ –1') wide, panicles. **CONCRETE JUICE** (lactucarium), usually in quarter sections of hemispherical masses, or in irregular angular pieces, dull reddish-brown or grayish-brown, internally light brown or yellowish, cut surface of a waxy lustre, somewhat porous; odor distinct, opium-like; taste strongly bitter. *Tests:* 1. Triturating with water gives turbid mixture; boiling with water softens it, giving a brownish liquid which, when cool, is not colored blue by iodine T. S. (abs. of starch), but is clarified by ammonia or alcohol; ammoniacal liquid is precipitated by calcium sulphate (presence of oxalic acid), alcoholic solution is not affected by ferric chloride (abs. of tannin); loses in drying 75 p. c. *Solvents:* water dissolves 51 p. c., diluted alcohol 36–44 p. c., spirit of chloroform 55–60 p. c., being mostly lactucerin. Dose, gr. 1–8–15 (.06–.5–1 Gm.).

FIG. 408.



*Lactuca virosa.*

**Commercial.**—The plant is cultivated chiefly in Germany, France, Great Britain, Austria; it has a disagreeable narcotic odor and a bitter, saline taste; all parts abound in a white, milky juice, which instantly exudes upon being wounded. We have several varieties of lactucarium:

1. *English.*—In England and Scotland the juice is collected in Aug.–Sept. (when the stalks become thick, succulent, and flower buds appear), by collectors passing up the rows, cutting off the heads of each stalk and scraping the exuding

## CICHORIACEÆ.

juice into small tin vessels—two scrapers following one cutter. This process is repeated 6–7 times daily for several weeks, each cut being made a little lower down the stalk. The juice by night has thickened into a viscid mass, when it is turned out of the vessels, divided into suitable-sized pieces, and dried by gentle heat, requiring about 5 days—the yield per plant being 3iij–4 (12–15 Gm.), and when dry 40–50 grains (2.6–3.3 Gm.). This powders with difficulty, and emulsifies only with acacia.

2. *German*.—Chiefly prepared near Zell, small town on the Moselle. Here the stems, just before flowering, are cut off a foot (.3 M.) below apex, and daily thereafter, from May to Sept., a thin transverse slice is removed. The white exuding juice soon becomes brown, when it is scraped from the scarified top with the finger and put into earthen pots, where it soon hardens, and afterward is turned out on frames and dried in the air. It enters market in angular lumps.

3. *French (Aubergier's)*.—This seldom reaches our market; it was cultivated originally and used by Aubergier himself, being the milky juice of *Lactuca sagitta'ta* (*altis'sima*), collected in glass vessels, from transverse incisions made daily from above downward. Upon coagulation, it is shaped into circular cakes 4 Cm. (1½') thick, and dried on sieves.

*Thridace*, or commercial French lactucarium, is the inspissated expressed juice from the lettuce stalks just before flowering.

CONSTITUENTS.—Lactucerin (lactucon) 50–60 p. c., Lactucin, Lactucic acid, Lactucopiecin, (caoutchouc, resin, sugar, oxalic, citric, and malic acids, gum, wax, asparagin, volatile oil, ash 7–10 p. c.).

Lactucerin,  $C_{28}H_{44}O_2$ .—Obtained from lactucarium with boiling alcohol and recrystallization; forms thin, colorless, tasteless, odorless needles, and is claimed to be the acetate of alpha- and beta-lactuceryl, soluble in hot alcohol, chloroform, ether, benzin, oils.

Lactucin,  $C_{11}H_{12}O_3H_2O$ .—This gives most of the bitter taste; occurs in odorless, white pearly scales or rhombic plates, soluble in hot water, alcohol, 60 parts cold water, insoluble in ether, turns red and then brown by alkalis, losing its bitterness, and by oxidation produces lactucopiecin. Dose, gr. 1–4 (.06–.26 Gm.).

Lactucic Acid and Lactucopiecin,  $C_{44}H_{32}O_{21}$ .—These are in the mother-liquor of lactucin, the former being crystalline, bitter, red with alkalis; the latter amorphous, bitter, both soluble in water, alcohol.

PREPARATIONS.—1. *Tinctura Lactucarii*. Tincture of Lactucarium. (Syn., Fr. Teinture de Lactucarium; Ger. Lactucariumtinktur.)

*Manufacture*: 50 p. c. Beat Lactucarium 50 Gm. to coarse powder with clean sand, add to this in bottle purified petroleum benzin 200 Cc. (to remove inert resinous lactucerin, caoutchouc, etc.), cork tightly, set aside 2 days, frequently agitating, filter, drain, wash residue with benzin 150, percolate powdered residue with glycerin 25, water 25, alcohol 50, then diluted alcohol q. s. to exhaust, evaporate to 100 Cc. Dose, 3ss–1 (2–4 Cc.).

Prep. : 1. *Syrupus Lactucarii*. Syrup of Lactucarium. (Syn., Fr. Sirop de Lactucarium ; Ger. Lactucariumsirup.)

*Manufacture* : Mix tincture of lactucarium 10 Cc., glycerin 20, add orange-flower water 5, in which has been dissolved citric acid .1 Gm., filter, add syrup q. s. 100 Cc. Dose, 3j-4 (4-15 Cc.).

*Unoff. Preps.* : *Fluidextract*, dose, mj-30 (.06-2 Cc.). *Lozenges*.

**PROPERTIES.**—Anodyne, sedative, hypnotic, diuretic, expectorant, very unreliable, milder than opium, and, unlike it, does not derange the digestive organs.

**USES.**—Where opium is objectionable, to procure sleep, allay cough, dropsy, palpitation of heart, intermittent fevers, nervousness.

*Allied Plants* :

1. *Lactuca canadensis* (*elongata*), *Wild Lettuce*.—The herb, official 1820-1850. N. America. Herb 1.3-3 M. (4-10°) high, hollow, purple, very leafy, smooth, glaucous ; leaves 15-30 Cm. (6-12') long, pinnatifid ; flowers yellow to purple, heads 20-flowered, panicles, rich, damp soil, fields, thickets. Juice from the plant, when in flower, makes good lactucarium ; that collected in early season is not bitter.

2. *L. sativa*, *Garden Lettuce*.—Juice is medicinal and more abundant in wild than in cultivated plants. Highly valued as salad, and as such acts as a feeble hypnotic. *L. sagittata* (*altissima*) ; large Caucasian plant 2.5-3 M. (8-10°) high, chiefly cultivated in France.

## 80. COMPOSITÆ. Composite (Thistle) Family.

Kom-poz'i-te. L. *Compositus* + æ, pp. of *componere*, compounded—i. e., referring to the two kinds of florets (ray and disk) composing each flower-head. Herbs, shrubs. Distinguished by being the largest family, by possessing bitter principles, watery or resinous (rarely milky) sap ; flowers (florets) 5's, in compound heads surrounded by involucre ; calyx superior, tube adnate to ovary, limb often pappose or membranous ; corolla epigynous, usually 5-lobed, stamens 5, epipetalous, syngenesious ; ovary inferior, 1-celled ; ovule 1, erect ; fruit achene ; universal ; tonic, laxative, anthelmintic (bitter principle), aromatic, carminative, diaphoretic, stimulant (volatile oil).

Genera : 1. *Eupatorium*. 2. *Grindelia*. 3. *Erigeron*. 4. *Calendula*. 5. *Anthemis*. 6. *Matricaria*. 7. *Anacyclus*. 8. *Artemisia*. 9. *Arnica*. 10. *Arctium*.

## EUPATORIUM. EUPATORIUM.

**Eupatorium**  
**perfoliatum**, Linné. } The dried leaves and flowering tops.

*Habitat*. N. America (Canada, United States) ; damp, swampy places, meadows, banks.

*Syn.* Thoroughwort, Boneset, Wood Boneset, Teasel, Ague-weed, Joe Pye, Feverwort, Cross-wort, Thorough-stem or -wax, Vegetable Antimony, Sweating Plant, Indian or Wild Sage, Tearal ; Fr. Herbe d'Eupatoire perfoliée, Herbe à Fièvre ; Herbe parfaite ; Ger. Durchwachsost, Durchwachsener Wasserdost.

## COMPOSITÆ.

**Eu-pa-to'ri-um.** L. fr. Gr. *εὖ*, well, + *πατήρ*, father—*i. e.*, born of noble father. After Mithridates Eupator, King of Pontus, who discovered one of the species.

**Per-fo-li-a'tum.** L. *per*, through, + *folium*, a leaf—*i. e.*, stem passes through (lamina or blade of) the leaf; leaves so clasping stem as to appear pierced by it.

*Thoroughwort* = *thorough*, through, + *wort*, a plant (leaf, root)—*i. e.*, stem apparently passing through the leaf.

*Boneset*—*i. e.*, relieves pains in limbs in influenza, hence sets bones and pains cease.

**PLANT.**—Hairy perennial; stem erect, .6–1.2 M. (2–4°) high, much branched at summit. **LEAVES**, opposite, the pair united at the base, 8–20 Cm. (3–8') long, 1.5–5 Cm. ( $\frac{3}{8}$ –2') broad, tapering regularly from near base to acute apex, crenate-serrate, rugosely veined, rough and bright green above, yellowish-gray-green, tomentose, resinous-dotted beneath, flower-heads small, numerous, corymbed, with campanulate involucre of lance-linear imbricated scales; flowers July–Sept.,

FIG. 409.

*Eupatorium perfoliatum*: flowering top.

10–15 tubular yellowish-white florets with bristly pappus in a single row; odor faintly aromatic; taste strongly bitter, astringent. Should be collected July, loses on drying 75 p. c. *Solvents*: water; alcohol. Dose, 3ss–1 (2–4 Gm.).

**CONSTITUENTS.**—Eupatorin, Volatile oil, resin, tannin, crystalline wax, gum, sugar, yellow coloring matter, ash 7.5 p. c.

**Eupatorin.**—Bitter, crystalline glucoside, soluble in hot water, alcohol, chloroform, ether. The "Eclectic" resinoid, *eupatorin*, is very different, being the precipitate resulting from throwing alcoholic tincture (evaporated) into water. Wax may be extracted by benzene or ether.

**PREPARATIONS.**—1. *Fluidextractum Eupatorii*. Fluidextract of

Eupatorium. (Syn., Extractum Eupatorii Fluidum, U. S. P. 1890, Fluidextract of Boneset; Fr. Extrait liquide d'Eupatoire; Ger. Flüssiges Durchwachsdestenenextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, ℥xv-60 (1-4 Cc.).

*Unoff. Preps.*: *Infusion*, 5 p. c., dose, ʒj-2 (30-60 Cc.; when cold—tonic, warm—emetic, diaphoretic). *Decoction*, 5 p. c., dose, ʒj-4 (30-120 Cc.; purgative). *Extract*, dose, gr. 5-20 (.3-1.3 Gm.).

**PROPERTIES.**—Stimulant, tonic, diaphoretic, (diuretic). Large doses emetic, aperient, antiperiodic, similar to chamomile. Was very popular with North American Indians, being used in hot tea or infusion until perspiration or vomiting occurred.

**USES.**—To prevent or break the chill in intermittent fever, muscular rheumatism, break-bone fever, bronchitis, influenza, dyspepsia, sore throat.

*Allied Plants*:

1. *Eupatorium purpu'reum*, *Gravel Root*, *Queen of the Meadow*.—The root, official 1820-1840. Perennial herb 1-2 M. (3-6°) high, stem green or purplish, purple band at joints, 2.5 Cm. (1') wide, leaves petiolate, 3-6 in whorl, 20-25 Cm. (8-10') long, 10-12.5 Cm. (4-5') wide, downy beneath, flowers purple to white, corymbs, dry woods, meadows; contains euparin; taste bitter, aromatic; astringent.

2. *E. verbenaceo'lium* (*teucrifo'lium*), *Wild Hoarhound*, *Rough Boneset*.—The herb, official 1820-1840. Perennial hairy herb .6-2.5 M. (2-8°) high; leaves ovate, oblong, truncate at base, toothed; flowers Aug., white, panicle corymb, considered by some only a variety of *E. perfoliatum*; low grounds. Both of these have properties similar to official.

3. *E. capillifo'lium* (*fœnicula'ceum*), *Dog-fennel*, *Hog-weed*.—Virginia to Florida. Plant smooth, 1-3 M. (3-10°) high; juice relieves pain from insect-bites.

## GRINDELIA. GRINDELIA.

**Grindelia** { *robusta*, Nuttall, } The dried leaves and flowering  
                  { *squarrosa*, (Pursh) Dunal. } tops.

*Habitat*. N. America (west of Rocky Mountains to Texas, Mexico; in salt marshes, along mountain ranges).

*Syn.* Gum-plant, Broad-leaved Gum-plant; Fr. Grindélia; Ger. Grindelie.

*Grin-de'li-a*. L. after D. H. Grindel (1776-1836), German botanist and professor at Riga and Dorpat.

*Ro-bus'ta*. L. *robustus*, oaken, strong, hardy, fr. *robur*, strength—i. e., the strongest, hardest variety.

*Squar-ro'sa*. L. *squarrosus*, scurfy, scaly, full of loose leaves—i. e., the involucre.

**PLANTS.**—1. *G. robusta*—perennial herb, .3-1 M. (1-3°) high, mostly in elevated regions, glabrous, achenes 2-3, at apex 1-3-toothed; 2. *G. squarrosa*, .4 M. (16') high, less leafy, woody, and bushy than preceding, mostly in the plains. **LEAVES**, 5 Cm. (2') long, broadly

## COMPOSITEÆ.

spatulate, oblong to lanceolate, sessile or clasping, obtuse, sharply serrate, often spinosely toothed, or laciniate-pinnatifid, pale green, smooth, finely dotted, coriaceous, brittle; heads resinous-viscid, many-flowered, either conical-urceolate (*G. squarrosa*), or depressed-urceolate (*G. robusta*), involucre hemispherical, 10 Mm. ( $\frac{2}{5}$ ') broad, composed of many imbricated, squarrosely tipped or spreading scales; ray-florets yellow, ligulate, pistillate, sometimes absent, disk-florets yellow, tubular, perfect, pappus of 2–3 mostly unequal awns about the length of disk-florets; odor balsamic; taste pungently aromatic, bitter. Should collect as soon as in full bloom. *Solvent*: alcohol. Dose, gr. 15–60 (1–4 Gm.).

**CONSTITUENTS.**—Resin, Bitter principle 1–2 p. c., Volatile oil, grindeline (bitter, crystalline, soluble in water, alcohol, ether), fixed oil, wax, sugar, caoutchouc, tannin (*G. robusta*) 1.5 p. c., ash 7–8 p. c.

**Resin.**—This is the active principle, acrid, so abundant as at times to coat over leaves and involucre, thus making them glutinous; hence the name gum-plant.

**Bitter Principle (Grindelin).**—A glucoside, considered to be a mixture of saponin and another saponin-like glucoside.

**Volatile Oil.**—This has turpentine odor; quantity very small.

**PREPARATIONS.**—1. *Fluidextractum Grindeliæ*. Fluidextract of Grindelia. (Syn., Extractum Grindeliæ Fluidum, U. S. P. 1890; Fr. Extrait liquide de Grindelia; Ger. Flüssiges Grindeliextrakt.)

*Manufacture*: Macerate, percolate 100 Gm. with alcohol 75 p. c., q. s., evaporate to 100 Cc. Dose, ℥xv–60 (1–4 Cc.).

*Unoff. Preps.*: *Extract*, dose, gr. 5–15 (.3–1 Gm.). *Tincture*. *Infusion*.

**PROPERTIES.**—Cardiac sedative, expectorant, antispasmodic, tonic, stomachic, diuretic; relaxes muscular coat of the bronchial tubes. Large doses produce narcosis, dilated pupils, impaired power of locomotion, increased urine. Resembles conium somewhat in action, and cases of poisoning should be treated similarly.

**USES.**—Asthma, bronchitis, whooping-cough, catarrh of bladder and uterus. Locally to burns, blisters, rheumatism, and poisoning by rhus toxicodendron; in solution or poultice. It is eliminated by the bronchial mucous membrane and the kidneys, stimulating both, the latter sometimes to the extent of renal irritation.

*Allied Plants*:

1. *Grindelia glutinosa* and *G. hirsutula*.—W. United States, stem of former often purple, tomentose; both are very similar to and often collected and mixed in with the official.

2. *Solidago odora*, *Sweet* or *Anise-scented Golden-rod*.—The leaves and tops, official 1820–1880. N. America. Perennial herb, .6–1 M. (2–3°) high, greenish-yellow, pubescent; leaves lanceolate, pellucid-dotted, 2.5–5 Cm. (1–2') long, 12 Mm. ( $\frac{1}{2}$ ') wide; flowers yellow, racemes; fruit achenes; odor and taste sweet, anise-like, more pronounced when bruised; contains volatile oil. Used for stimulant, rubefacient, anodyne, carminative, diaphoretic, aromatic, for hemorrhages, colic, neuralgia, amenorrhœa, rheumatism; infusion, oil. Dose, ʒss–2 (2–8 Gm.); oil, ℥j–5 (.06–.3 Cc.).

## ERIGERON CANADENSE. CANADA FLEABANE.

Oleum Erigerontis. Oil of Erigeron, *official*.

**Erigeron canadense**, *Linné*. } A volatile oil, distilled from the  
**(Leptilon canadense, (Linné) Britton.)** } fresh flowering herb.

*Habitat.* N. America, in fields, waste places; naturalized in other countries.

*Syn.* Canada Erigeron, Butter-, Pride-, Horse-, Bitter-, or Fire-weed, Mare's, Colt's, Cow's, or Horse Tail, Scabious, Blood-staunch, Oil of Fleabane; Fr. Herbe d'Erigeron, Herbe de Vergerette, Essence d'Erigeron; Ger. Beschreikraut, Oleum Erigerontis Canadensis, Oil of Canada Fleabane.

**Er-ig'e-ron.** L. Fr. Gr. *ἔρις*, early, + *γέρων*, old, an old man, suggested by hoariness of some vernal species, equiv. to *senecio*, groundsel, lit. early old.

**Can-a-den-se.** L. *canadensis*, Canadian—i. e., its original habitat.

**Lept'il-lon.** L. fr. Gr. *λεπτάλλος*—*λεπτός*, fine, small, delicate—i. e., from the small heads.

*Fleabane*—*flea* + *bane* = death to fleas—i. e., supposed to drive them away.

**PLANT.**—Annual herb, .3–2.5 M. (1–8°) high, abounding in neglected fields, having all parts medicinal; stem branching, hairy, furrowed; leaves linear-lanceolate, entire or dentate; flowers July–Oct., small, numerous, white, in terminal panicles.

**CONSTITUENTS.**—Volatile oil 0.2–0.4 p. c., bitter principle, tannin.

**Oleum Erigerontis.** Oil of Erigeron.—Obtained by distilling with water or steam; it is a pale yellow liquid, darker and thicker with age and exposure; odor peculiar, aromatic, persistent; taste aromatic, pungent, sp. gr. 0.850; contains dextrogyrate limonene,  $C_{10}H_{16}$ , + a substance easily decomposed or polymerized by heat, hence it is distilled with difficulty under ordinary pressure. *Test*: 1. Soluble in equal volume alcohol (dis. from oil of fireweed—*Erechtithes hieracifolia*, and oil of turpentine), also in equal volume glacial acetic acid, which solution with bromine yields crystals of  $C_{10}H_{16}Br_4$ . Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose,  $\text{m}\nu$ –10 (.3–.6 Cc.).

**PROPERTIES.**—Stimulant, tonic, diuretic, diaphoretic, styptic.

**USES.**—Was recognized first by "Eclectics," who used it for diarrhœa, dysentery, gravel, dropsy, hemorrhages of uterus and bowels. Acts like oil of turpentine, but less irritant and stimulating.

*Dried leaves and flowering tops*, official 1820–1880; decoction, 5 p. c., dose, 3ss–j (15–30 Cc.).

*Allied Plants*:

1. *Erigeron an'nuus* (*heterophyll'us*), *Various-leaved Fleabane*, *Sweet Scabious*.—The herb, official 1830–1880. Biennial herb, 1–1.5 M. (3–5°) high, branched, hairy, leaves sharply, coarsely toothed; flowers Aug., corymbs, rays white tinged with purple, disk yellow; in fields, waste places.

2. *E. philadel'phicus*, *Philadelphia Fleabane*.—The herb, official 1820–1880. Perennial herb, .3–1 M. (1–3°) high, pubescent, slender, leafy; leaves 5–10 Cm. (2–4') long, 12–18 Mm. ( $\frac{1}{2}$ – $\frac{3}{4}$ ') wide, broad midrib, flowers June–Aug., numerous, paniced corymbs, rays 150–200,

## COMPOSITÆ.

filiform purplish, disk yellow. Both have same constituents and properties as *Erigeron canadense*.

3. *Gnaphalium obtusifolium* (*polycephalum*), *Common, Sweet, or Fragrant Life Everlasting*.—Annual erect herb, .3–1 M. (1–3°) high, woolly, fragrant; leaves lanceolate, undulate, sessile, flowers in heads, clustered at summit of corymbose branches, obovate, whitish involucre, yellow, tubular, odor pleasant, bitter; contains volatile oil and bitter principle. Used for diarrhœa, hemorrhages, externally in fomentation and as a vulnerary to bruises, ulcers, etc. Dose, 3ss–1 (2–4 Gm.).

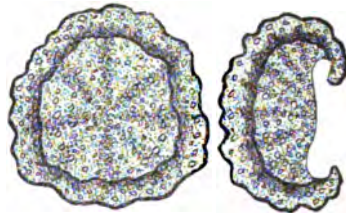
4. *Inula Helénium*, *Inula*, *Elecampane*.—The root, official 1820–1900; C. and S. Europe, C. Asia. Perennial herb, 1–2 M. (3–6°) high; stem thick, solid, striate, villous; leaves large, .3–.5 M. (10–18') long, 10–20 Cm. (4–8') wide, ovate, serrate, pubescent beneath, long-petioled, fleshy midrib; flowers large, 6 Cm. (2½') wide, single, golden-yellow. Root, dug in autumn of the second year, 15–30 Cm. (6–12')

FIG. 410.

*Inula Helenium.*

long, 18–25 Mm. (¾–1') thick; usually in transverse, concave slices or longitudinal sections, with overlapping bark, wrinkled, brownish, fracture short, radiate, dotted, with resin-cells, free from starch; odor peculiar, aromatic; taste bitter, pungent; contains volatile oil, acrid resin, bitter principle, inulin, helenin, wax; solvents:

FIG. 411.

*Inula*: transverse section, natural size.

alcohol, water partially. Stimulant, diaphoretic, diuretic, expectorant, emmenagogue, tonic; lung diseases, bronchitis, vesical catarrh, amenorrhœa, dyspepsia, skin affections, dropsy, whooping-cough, diphtheria. Dose, 3ss–1 (2–4 Gm.); fluidextract, 3ss–1 (2–4 Cc.); infusion, 5 p. c., 3j–2 (30–60 Cc.); decoction, 3j–2 (30–60 Cc.).

5. *I. squarro'sa*.—S. Europe. Leaves tomentose, rugose, ray-florets 3-cleft, tubular; emmenagogue, diuretic, powder burned to repel insects.

6. *Pulica'ria* (*Inula*) *dysenter'ica*, *Fleawort*; used like the preceding. *Carlina acan'this*, Europe; contains volatile oil, resin, similar to elecampane in odor, etc.; diaphoretic, diuretic, large doses purgative, typhoid condition, impotence, amenorrhœa, paralysis of the tongue. Dose, gr. 10–20 (.6–1.3 Gm.).



## CALENDULA. CALENDULA.

**Calendula officinalis**, Linné. } The dried ligulate florets.

*Habitat.* S. Europe, Levant; cultivated universally in gardens for ornament.

*Syn.* Marigold, Garden or Pot Marigold, Mary-bud, Gold-bloom, Holigold, Jack-napes-on-horseback; Fr. Souci, Fleurs de Tous les Mois; Ger. Ringelblume, Todtenblume.

**Ca-len'du-la.** L. deriv. fr. *calendæ*, calends, the first day of the month—i. e., it produces flowers almost every month in the year.

**Of-fi-ci-na'lis.** L. see etymology of (*Asagraea*) *officinalis*, page 101.

**PLANT.**—Annual herb; stem .3–.6 M. (1–2°) high, angular, roughish-hairy; leaves toothed, spatulate, oblanceolate; flower-heads terminal, 5 Cm. (2') broad, involucre flattish, hemispherical, 2-rowed; ray-florets, one or several rows, disk-florets, many, tubular, 5-cleft, yellow, much diminished by drying. **LIGULATE (RAY)-FLORETS** (*calendula*), 15–25 Mm. ( $\frac{3}{8}$ –1') long, 3–6 Mm. ( $\frac{1}{8}$ – $\frac{1}{4}$ ') wide, yellow or orange-colored, 1–3-toothed, the short hairy tube occasionally enclosing remnants of a filiform style and bifid stigma, without pappus, odor slight, somewhat heavy, taste slightly bitter, faintly saline. *Solvents*: alcohol; boiling water partially. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—*C. arven'sis*, often cultivated; smaller, more spreading, flowers light yellow, achenes nearly straight. *Tage'tes erecta* and *T. pat'ula*. Mexico, tropical America; cultivated as French or African marigold. Flowers substituted for official, but have tubular involucre (owing to the scales uniting), pappus, and often reddish florets.

**CONSTITUENTS.**—Volatile oil, bitter principle (amorphous), calendulin (gummy, analogous to bassorin, yellow, tasteless, soluble in alcohol, insoluble in ether, swells into a jelly with water), fat, resin, sugar, gum.

**PREPARATIONS.**—1. *Tinctura Calendulæ*. Tincture of Calendula. (Syn., Tincture of Marigold; Fr. Teinture de (Souci) Fleurs de Tous les Mois; Ger. Ringelblumetinktur, Calendulatinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol q. s. 100 Cc. Dose, ʒss–2 (2–8 Cc.).

*Unoff. Preps.*: *Decoction*, dose, ʒj–2 (30–60 Cc.). *Extract*, dose, gr. 2–10 (.13–.6 Gm.). *Fluidextract*, dose, ℥xv–60 (1–4 Cc.).

**PROPERTIES.**—Stimulant, tonic, febrifuge, anthelmintic, resolvent.

**USES.**—Formerly in jaundice, amenorrhœa, scrofula, low fevers, vomiting. Both internally and externally in cancer, ulcers, wounds, otitis. The tincture mostly as an embrocation in sprains, bruises, etc., instead of tincture of arnica or myrrh; the powder in chafing. This is a popular remedy in “homeopathic surgery.”

COMPOSITÆ.

ANTHEMIS. ANTHEMIS.

**Anthemis nobilis**, Linné. } The dried flower-heads, collected from cultivated plants.

*Habitat.* S. and W. Europe, gravelly roadsides (cultivated in Germany, Great Britain (Micham's drug farms), France, Belgium; naturalized somewhat in the United States).

*Syn.* Chamomile, Roman, Garden, English, Scotch, White or Low Chamomile, Ground Apple, Whig Plant, Camomile; Br. Anthemidis Flores; Fr. Camomille Romaine; Ger. Römische Kamille.

**An'the-mis.** L. fr. Gr. ἀνθεμῖς—ἀνθος, a flower—i. e., from its numerous flowers.

**No/bil-is.** L. famous, noble—i. e., from the appreciation of its handsome yellow flowers.

**PLANT.**—This has also been named *Chamomilla nobilis*, and is a trailing perennial; stem 15–30 Cm. (6–12') long, hairy; leaves bi- or tripinnatisect, hairy. **FLOWERS**, June–Sept., 18 Mm. ( $\frac{3}{4}$ ') broad, subglobular, consisting of imbricated involucre, and many white, strap-shaped, obscurely 3-toothed ray-florets, and usually a few tubular disk-florets, inserted upon a chaffy, conical, solid receptacle; odor agreeable; taste strongly aromatic, bitter. *Solvents*: alcohol; hot water. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—Flowers of *Anthemis arven'sis*, *Anthemis* (*Maruta*) *Cotula*, *Matricaria Chamomilla*, *Chrysanthemum* (*Pyr'ethrum*) *Parthe'nium*, and *Achillea Ptar'mica*. All these are smaller than official; the first three being wild-grown, have single whorls of ray-florets. *Chrysanthemum* receptacle is naked, convex. *Achillea* rays are round, short, inodorous, acrid.

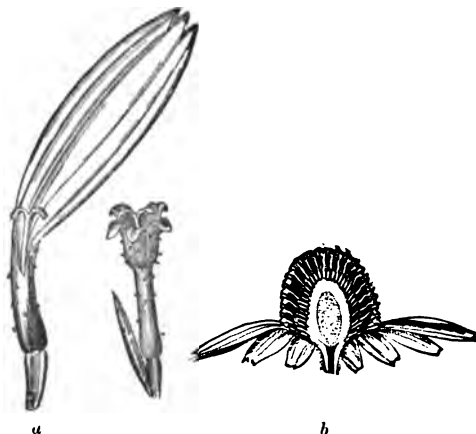
**Commercial.**—The wild-grown flowers have only 1 whorl of ray-florets, hence called single; the cultivated flowers have yellow disk-

FIG. 412.



*Anthemis nobilis*: wild.

FIG. 413.



*Anthemis*: a, ray- and disk-floret, magnified 4 diam.; b, section through single flower-head, natural size.

florets more or less converted into white ray-florets, giving commercially the double, which are larger, more highly and finely aromatic, therefore preferred, although the unaltered disk contains more aroma and possibly more bitter principle; to retain color and activity must be dried quickly.

**CONSTITUENTS.**—Volatile oil 1 p. c., anthemine acid (bitter principle), anthemene (anthemidin),  $C_{18}H_{36}$ , resin 5.25 p. c., tannin, fixed oil, glucose, ash 6 p. c.

**Volatile Oil (Oleum Anthemidis).**—This is a bluish-green to yellowish liquid, acid, sp. gr. 0.910. Contains anthemol,  $C_{10}H_{16}O$ , + isobutyl esters of isobutyric and angelic acids, amyl esters of tiglic and angelic acids, the hexyl esters of tiglic and angelic acids. Dose,  $\text{Mj}$ –5 (.06–.3 Cc.), on sugar.

**Anthemine Acid.**—Obtained by exhausting flowers with hot acidulated (acetic) water, concentrating, precipitating with alcohol, evaporating filtrate, treating with chloroform; the alcoholic precipitate contains anthemene (anthemidin); occurs in colorless silky needles, agreeable chamomile odor, strong bitter taste, soluble in water, alcohol, chloroform, ether; anthemidin occurs in tasteless crystals, insoluble in alcohol, ether, chloroform, soluble in acetic acid.

**PREPARATIONS.**—(Unoff.) *Extractum Anthemidis* (Br. aqueous), dose, gr. 2–8 (.13–.5 Gm.). *Fluidextract*, dose, 3ss–1 (2–4 Cc.). *Infusion* (best form), 5 p. c., dose,  $\text{3j}$ –2 (30–60 Cc.). *Poultice*.

**PROPERTIES.**—Stimulant (volatile oil), tonic (anthemine acid), carminative, nervine, emmenagogue. Warm infusion an emetic; cold infusion a tonic; oil is also antispasmodic. Large doses cause vomiting, diarrhoea, pain and fullness in head, drowsy intoxication.

**USES.**—Weak digestion, general debility, intermittents, torpid liver, delirium tremens, as a masticatory in dyspepsia. Externally for colic, toothache, earache, rheumatism, ulcers, sprains; in poultice with vinegar, laudanum, etc. Oil used locally for rheumatism, flatulent colic.

*Allied Plants:*

1. *Anthemis (Maru'ta) Cot'ula, Mayweed.*—The herb, official 1820–1880. N. America. Annual plant in fields, roadsides, .3–.6 M. (1–2°) high, greenish, furrowed, leaves thrice pinnatifid; flowers June–Sept., receptacle solid, conical, chaffy, ray-florets white, disk yellow; contains volatile oil, valeric (valerianic) acid, fat, tannin, anthemidine (?), anthemine acid. Used as stimulant, antispasmodic, sudorific, emmenagogue, vesicant for hysteria, colic, dysmenorrhoea; in infusion. Dose, 3ss–2 (2–8 Gm.).

FIG. 414.



*Achillea Millefolium.*

2. *Achillea Millefolium, Yarrow, Milfoil.*—The leaves and flowering tops, official 1860–1880. N. America. Perennial herb, .3–.6 M. (1–2°) high, hairy; leaves lanceolate, glandular beneath, 5–25 Cm. (2–10') long, twice pinnatifid, segments toothed; flowers Aug., corymbs, receptacle flat, chaffy, ray-florets white, pistillate;

disk white, perfect; fruit achenes, chamomile odor, taste bitter, aromatic; contains volatile oil, achilleine, resin, tannin. Used as stimulant,

**COMPOSITEÆ.**

tonic, emmenagogue; amenorrhœa, menorrhagia, piles, leucorrhœa, colic, relaxed throat, sore nipples, intermittents; infusion, expressed juice. Dose, 3ss–1 (2–4 Gm.); oil, ℥v–15 (.3–1 Cc.).

**MATRICARIA. MATRICARIA.**

**Matricaria**  
**Chamomilla**, Linné. } The dried flower-heads.

*Habitat.* Europe, W. Asia (naturalized in Australia, cultivated in German settlements in United States).

*Syn.* German Chamomile, Wild Chamomile, Horse-gowan; Fr. Fleurs de Chamomille commune (d'Allemagne); Ger. Flores Chamomillæ (Vulgaris), Kamillen, Kamillenblumen.

**Mat-ri-ca'ri-a.** L. fr. *matrix*, *matrice*, the womb—i. e., its supposed effect on that organ; name used by the medieval pharmacists.

**Cham-o-mil'la**, better *Camomilla*. L. fr. Gr. *χamai*, on the earth, + *μήλον*, an apple, lit. "earth apple"—i. e., from odor of the bruised plant and flowers (Dioscorides).

**PLANT.**—Annual herb; stem .3–.6 M. (1–2°) high, branched, smooth, solid, striate, pale green; leaves 5 Cm. (2') long, lower tripinnate, upper bipinnate, green, smooth; leaflets linear, small. **FLOWERS.** May–Aug., 6–8 Mm. ( $\frac{1}{4}$ – $\frac{1}{3}$ ') broad, exclusive of the rays, with a flattish imbricated involucre, conical, hollow, naked receptacle, 10–20 white ligulate, reflexed pistillate ray-florets, 8 Mm. ( $\frac{1}{3}$ ') long, numerous yellow, tubular, perfect disk-florets without pappus; odor somewhat disagreeably aromatic; taste strongly aromatic, bitter. *Solvents*: boiling water; alcohol. Dose, gr. 15–60 (1–4 Gm.).

**ADULTERATIONS.**—*Anthemis arvensis* and *A. (Maruta) Cotula* have very similar flower-heads, but their receptacles are conical, solid, and chaffy.

**CONSTITUENTS.**—Volatile oil 0.25 p. c., Anthemidic acid, anthemidin, extractive, tannin, malates.

**Volatile Oil.**—Obtained by distilling entire plant or flowers; dark blue liquid, due to azulene, sp. gr. 0.940, soluble in alcohol; consists of a paraffin-like body, terpene,  $C_{10}H_{16}$ , and a colorless oil, anthemol,  $C_{10}H_{16}O$ . An artificial oil is used in Germany (flowers 480 parts + oil of lemon 1 part, distilled with water); it is deep blue, more limpid, and changes color easier than the pure oil. Dose, ℥j–5 (.06–.3 Cc.), on sugar, in pill or ether.

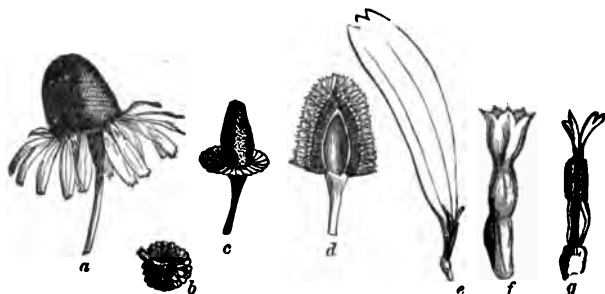
**PREPARATIONS.**—(Unoff.) *Oleum Chamomillæ Infusum* (flowers 10 parts, olive oil 100 parts, digested 2 hours). Used externally. *Syrup* (flowers 3 parts, water for infusion 10, + sugar 18). *Infusion*, 5 p. c., when cold a tonic, when warm an emetic. Dose, *ad libitum*. *Poultice*.

FIG. 415.

*Matricaria Chamomilla.*

PROPERTIES.—Stimulant (volatile oil), tonic (anthemic acid), carminative, diaphoretic, nervine, emmenagogue, antispasmodic, anthelmintic less agreeable than *Anthemis nobilis*, but may be substituted for it.

FIG. 416.



*Matricaria*: a, flower-head; b, involucre; c, receptacle and involucre; d, longitudinal section of receptacle, with disk-florets; e, ray-floret; f, disk-floret; g, stamens and style of disk-floret.

USES.—Warmth to stomach, to aid digestion in convalescence, general debility, intermittents, delirium tremens, flatulent colic; externally—local pains, intestinal and uterine colic, toothache, earache, abscesses, sprains, rheumatism.

## PYRETHRUM. PYRETHRUM.

**Anacyclus**  
**Pyrethrum**, (Linné) De Candolle. } The root.

*Habitat.* N. Africa, Algeria, Barbary, high lands; cultivated in gardens.

*Syn.* Pellitory, Pellitory of Spain, Spanish Chamomile, Alexander's Foot, Radix Pyrethri Romani; Fr. Pyrèthre officinal, Salivaire; Ger. Römische Bertramwurzel.

**An-a-cy'clus.** L. abr. fr. *Ananthocyclus*, old generic name, fr. Gr. *á*, not, + *ἀνθος*, a flower, + *κύκλος*, a circle—i. e., the outer circle of ovaries being without flowers.

**Py-re'thrum.** L. fr. *πῦρ* (*εῖρον*), fire—i. e., roots spicy taste, feverfew.

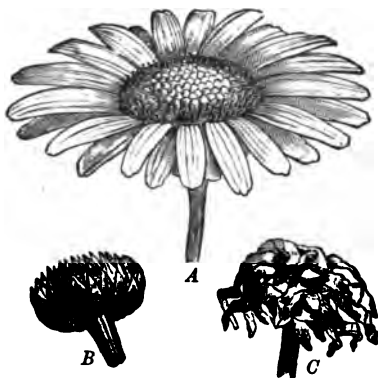
*Pel'li-tory.* Corrupt. of *parietary*, L. *parietaria*, the wall plant, *paries*, a wall—i. e., grows on walls.

**PLANT.**—Procumbent perennial, resembling chamomile; stems numerous, trailing at base, erect in the upper portion, .3 M. (1°) high, terminated by 1 large flower; leaves doubly pinnate, segments linear, pale green, hairy or glabrous; flowers April–June, terminal heads, 2.5–4 Cm. (1–1½') wide; rays white above, reddish-purple below and on edges, disk wide, yellow; fruit compressed, obovate, achene smooth, with narrow wing and pappus. **ROOT**, 5–10 Cm. (2–4') long, 3–20 Mm. (¼–⅔') thick, somewhat fusiform, nearly simple, dark brown, grayish-brown, longitudinally wrinkled, furrowed, crown somewhat annulate, at times tufted with coarse fibres or soft woolly hairs, fracture short; bark dark brown, resinous, 0.5–1 Mm. (⅓–½') thick, closely adhering to the light yellow, radiate, porous wood; medullary rays slender with 4 circles of shining resin-cells; odor distinct; taste pungent, acrid, sialagogue; collected in autumn. *Solvents*: alcohol, boiling water partially. *Dose*, 3ss–1 (2–4 Gm.).

**COMPOSITEÆ.**

*Commercial.*—It has been cultivated sparingly in Europe since 1570 ; ours comes solely from Algeria, via Oran and Algiers, or via Tunis, thence to Leghorn, Egypt, India, etc. ; although sometimes called Pellitory of Spain, very little comes from that country.

FIG. 417.



*Anacyclus Pyrethrum*: A, expanded flower; B, involucre seen from below; C, dried flower.

FIG. 418.



*Pyrethrum*: transverse section, magnified 3 diam.

**CONSTITUENTS.**—Pyrethrine, brown acrid resin (containing peltorin), 2 potassa-soluble acrid fixed oils (one brown, the other yellow), inulin 50 p. c., tannin, volatile oil, gum.

**Pyrethrine.**—This alkaloid is believed to contribute most of the activity ; it is decomposed by alcoholic solution of potassium hydroxide into piperidine and pyrethric acid, resembling piperic acid.

**PREPARATIONS.**—1. *Tinctura Pyrethri.* Tincture of Pyrethrum. (Syn., Tincture of Pellitory ; Fr. Teinture de Pyrèthre ; Ger. Bertramwurzeltinktur.)

*Manufacture*: 20 p. c. Macerate, percolate 20 Gm. with alcohol, q. s. 100 Cc. Dose, ʒss–2 (2–8 Cc.).

*Unoff. Preps.*: *Fluidextract*, dose, ʒss–1 (2–4 Cc.). *Decoction*. *Alcoholic Extract*. Gargle ; all mostly used externally. *Masticatory*.

**PROPERTIES.**—Irritant, rubefacient, sialagogue, sternutatory. When chewed have prickling sensation in the tongue and fauces, with heat, acidity, pungency, copious flow of saliva and mucus. Large doses may cause bloody diarrhœa, quick pulse, spasms, stupor ; stimulation is due to direct irritation of nerve-ends locally, which soon depresses nerves and blunts their sensibility.

**USES.**—Administered by mastication ; headache, rheumatism, neuralgia, toothache, paralysis of tongue or throat, relaxed uvula, chronic catarrh ; alcoholic tincture or extract, as an anæsthetic in carious teeth.

*Allied Plants* :

1. *Anacyclus officina'rum*, *German Pellitory*.—Cultivated in Saxony, Bohemia, Prussia, near Magdeburg, and is considered to be the annual form of the official plant ; root 6 Mm. ( $\frac{1}{4}$ ') thick, smaller than official,

bark thick with 1 circle of resin-cells, medullary rays without resin-cells.

2. *Chrysanthemum* (*Pyrethrum*) *roseum* and *C. carneum*, *Persian Pellitory*—*Persian* (*Caucasian*) *Insect Powder*.—W. Asia, Persia. Perennial plants, resembling chamomile; flower-heads 4 Cm. ( $1\frac{3}{5}$ ') broad; used only for killing insects; ray-florets rose-colored, anthers included (*roseum*), or purple with anthers projecting (*carneum*).

3. *C. cinerariæfolium*, *Dalmatian Insect Powder*.—Dalmatia. These flowers are most valuable when collected immediately after expansion. They yield an insect-powder much inferior in activity, which is thought to depend in every case for the insecticidal effect upon the volatile oil, or acid resin. *Tests*: 1. Put 4 gr. (.25 Gm.) of the powder upon a fly in a vial—it should be stupefied in 1 minute and dead in 2 or 3 minutes. 2. With microscope can recognize scarcity of pollen and abundance of collenchymatous tissue when much stem and few flowers are used. Powder often adulterated with other compositous plant flowers, as *Chrysanthemum Leucanthemum* (*Leucanthemum vulgare*), white-weed, oxeye or field daisy, and *C. segetum*. Neither of these is an insecticide, but will produce dermatitis in some persons.

4. *Tanacetum vulgare*, *Tanacetum*, *Tansy*.—The leaves and tops, official 1820–1900; Europe, Asia. Perennial herb, .6–1 M. ( $2-3^{\circ}$ ) high; stem obscurely hexagonal, striated, often reddish; root fibrous, many-headed; flowers yellowish discoid, dense, terminal corymbs; fruit achene, small, oblong, 5–6 ribs, crowned with pappus. Leaves, 15 Cm. (6') long, bipinnatifid, segments obtuse, oblong, serrate, glandular, receptacle convex, naked, florets tubular; odor strong, aromatic; taste pungent, bitter; contains volatile oil 0.25 p. c., tanacetin, fat, resin, tannin, mucilage; solvents: alcohol, water. Stimulant, tonic, emmenagogue, anthelmintic, diuretic, narcotic; large doses cause vomiting, convulsions, coma, mydriasis, feeble respiration and pulse, death from paralytic asphyxia. Used in intermittents, hysteria, amenorrhœa, colic, abortifacient; locally for bruises, sprains, rheumatism, ulcers. Dose, gr. 15–60 (1–4 Cc.); fluidextract, Mxv–60 (1–4 Cc.); infusion, 5 p. c., 3j–2 (30–60 Cc.); oil, Mj–5 (.06–.3 Cc.).

FIG. 419.



*Tanacetum vulgare*: flower;  
a, single flower.

5. *T. vulgare* var. *crispum*, *Double Tansy*.—Leaves twice pinnatifid, curled. *T. Balsamita* (*Pyrethrum Tanacetum*), S. Europe; odor strong, taste bitter. Both often cultivated and used similar to the official.

## SANTONICA. SANTONICA.

### *Artemisia*

*pauciflora*, (*Ledebour*) *Weber*. } The dried unexpanded flower-heads.

*Habitat*. N. Turkestan, Russia, on the vast plains of Kirghiz.

*Syn*. Levant Wormseed, Aleppo, Alexandria or European Wormseed, Tartarian Southern Wood, Semen Santonici—Cynæ—Sanctum or Contra; Fr. Barbotine, Semencine; Ger. Flores Cing, Wurmsamen, Zittwersamen.

*Ar-to-mis'i-a*. L. fr. Gr. Ἀρτεμῖς, the goddess; Roman Diana, to whom *Artemisia Absinthium* was dedicated, owing to its use in hastening puberty.

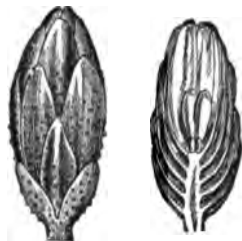
## COMPOSITÆ.

**Pau-ci-fl'o-ra.** *L. paucus*, few, + *florus*, flower—i. e., has few blooms, mostly only buds.

**San-ton'i-ca.** *L. santonicus*, pertaining to the Santoni, people of Aquitania (Gr. *σαντονικόν*, their wormwood), named in commemoration, which name survives to the place Saintes, in France.

**PLANT.**—Small, semi-shrubby perennial, with knotty, fibrous root-stocks, branching from crown, from which many erect, flowering stems arise, .3 M. ( $1^{\circ}$ ) high; stems 6–8, woolly or glabrous, at first leafy; leaves bipinnatisect, 12 Mm. ( $\frac{1}{2}$ ') long, woolly when young, afterward grayish. **FLOWERS**, 2–4 Mm. ( $\frac{1}{12}$ – $\frac{1}{6}$ ') long, 1 Mm. ( $\frac{1}{25}$ ') wide, oblong-ovoid, slightly flattened, obtuse, smooth, glossy, grayish-green, after exposure to light brownish-green, consisting of an involucre of 12–18 closely imbricated, glandular scales, with broad midribs, enclosing 4–5 rudimentary florets; odor strong, peculiar, camphoraceous; taste aromatic, bitter. **Solvents**: diluted alcohol; hot water partially. **Dose**, gr. 15–60 (1–4 Gm.).

FIG. 420.



Santonica: head and longitudinal section, magnified 10 diam.

**Commercial.**—The source *Artemisia maritima* var. *pauciflora* is equally correct, and is preferred by some writers, despite its having escaped far from its original maritime habitat. In Europe have two commercial varieties: 1. *Aleppo*, *Alexandria*, *Levant*. 2. *Barbary* (*A. Sieberii* and *A. ramo'sa*). The former is forwarded to the fair of Nizhnee-Novgorod, and thence enters market via Moscow, St. Petersburg, W. Europe; the latter is met with rarely, as it (flower-heads) contains no santonin.

**CONSTITUENTS.**—Santonin 1–2 p. c., Volatile oil 2–3 p. c., artemisin,  $C_{15}H_{18}O_4$  (in santonin mother-liquor, recrystallizing pure from chloroform), resin, gum.

**Santoninum.** **Santonin**,  $C_{15}H_{18}O_3$ , *official*. — (Syn., Anhydrous Santoninic Acid; Fr. Santonine; Ger. Santonin.) This inner anhydride or lactone of santonie acid was discovered in 1830; may be obtained by mixing powdered santonica (5) with slaked lime (1), exhausting with hot water; the filtered solution, containing calcium santonate, is concentrated and decomposed with hydrochloric acid, giving calcium chloride in solution and santonin precipitated along with resinous matter, which may be freed by washing with dilute ammonia water, or recrystallizing from hot alcohol; it occurs in white, shining, odorless, slightly bitter prisms, yellow on exposure, no residue, soluble in 34 parts alcohol, 2.5 chloroform, ether 78, water 5,300, and in alkalis. **Tests**: 1. Dissolves in nitric or sulphuric acid without color; the latter solution turns red upon standing or violet by the addition of ferric chloride; water added to red solution gives brown resinous precipitate. 2. With alcoholic potassium hydroxide T. S. get red liquid, becoming colorless. 3. Solution in sulphuric acid is colorless (abs. of sugar, other organic substances), but turns yellow, red, finally brown; if to this fresh solution add water, get complete precipitation of santonin, and the supernatant colorless liquid should neither be bitter nor altered by



potassium dichromate T. S. (abs. of brucine, strychnine), or by mercuric potassium iodide T. S. (abs. of alkaloids). It should be kept dark, in dark amber-colored vials, as sunlight converts it, owing to resinous nature, into yellow photo-santoninic acid,  $C_{15}H_{22}O_5$ . Heating with alkalis converts it into santoninic acid,  $C_{15}H_{20}O_4$ , while prolonged boiling with baryta water changes it into the isomeric santoninic acid. Dose, gr. 1-4 (.06-.26 Gm.); child, gr.  $\frac{1}{4}$ -1 (.016-.06 Gm.).

ADULTERATIONS.—Salicin, boric acid, strychnine, picric acid. Add sulphuric acid to santonin, at first colorless (abs. of salicin, which turns red). Boric acid insoluble in chloroform, non-volatile, gives green color to alcohol flame, and heated upon foil leaves glassy mass, the solution of which turns turmeric paper brown. Picric acid explodes by heat or percussion; forms yellow salts and precipitates gelatin in aqueous solution.

Volatile Oil.—Obtained by distilling with water or steam; yellowish, disagreeable odor; consists mainly of cineol,  $C_{10}H_{18}O$ , some dipentene, sp. gr. 0.930, when shaken with iodine get greenish crystals.

PREPARATIONS.—1. *Trochisci Santonini*. Troches of Santonin. (Syn., Santonin Lozenges; Fr. Tablettes (Pastilles) de Santonine; Ger. Pastilli Santonini, Santoninpastillen.)

Manufacture: Santonin 3 Gm., sugar 90, tragacanth 3, stronger orange-flower water q. s. 100 troches. Should be kept in dark amber-colored vials. Dose, 1-6 troches.

Unoff. Preps.: I. FLOWER-HEADS: *Infusion*. *Extract*. *Electuary*. II. SANTONIN: *Sodii Santoninas*, official 1880-1890, dose, gr. 2-10 (.13-.6 Gm.). *Trochisci Sodii Santoninatis*, official 1880-1890 (each gr. 1; .06 Gm.), dose, 1-4 troches. *Santoninic Acid*, dose, gr. 1-4 (.06-.26 Gm.).

PROPERTIES.—Anthelmintic, stimulant, emmenagogue. The Crusaders introduced santonica into Europe, and it has been used there ever since, mostly now as santonin. It is absorbed as sodium santoninate, and eliminated by the kidneys; large doses dilate pupils, cause gastric oppression, nausea, vomiting, diarrhoea, thirst, cold, clammy skin, giddiness, cerebral congestion, yellow vision (xanthopsia) changing to purplish-red, convulsions, death. Santonin in 5-grain (.3-Gm.) doses is a strong diuretic, imparting to normal acid urine a saffron color (as does rhubarb), which, by age, hence alkalinity, becomes violet-purple. A child 5 years old was killed by 2 grains (.13 Gm.).

USES.—For round worms (*Ascaris lumbricoides*), sometimes for thread-worms (*Oxyuris vermicularis*), but never for tape-worm. Santonin kills the round worms that inhabit the small intestine; therefore, purgatives having specific action here should be selected. Give the powder in honey, molasses, to which calomel or jalap has been added, at bedtime, having fasted that day; follow this next morning, before food, with a draught of senna or a dose of castor oil. A suppository is serviceable for thread-worms. May reserve entire cathartic until next morning if desirable. Useful in incontinence of urine, eye affections due to inflammatory changes of optic nerve and retina. Never give to children with fever nor while constipated, owing to pos-

## COMPOSITÆ.

sible toxic results, which are combated by ammonia, strychnine, eliminants, artificial respiration.

*Allied Products:*

1. *Barbary Wormseed* (*A. ramo'sa*).—N. W. Africa. Unexpanded flower-heads are rounder than the official and are covered with whitish down, by which they can readily be recognized.

2. *Indian Wormseed*.—Europe. Only half size of *santonica*, hairy and more yellow. The American wormseed are often substituted for *santonica*, but their resemblance, on close inspection, is very slight.

*Allied Plants:*

1. *Artemisia Absinthium*, *Absinthium*, *Wormwood*.—The leaves and tops, official 1840–1900. Europe, N. Asia, N. Africa. Perennial herb; stem .6–1 M. (2–3°) high. Leaves, 2.5–7.5 Cm. (1–3') long, hoary, grayish-green; flowers, in heads, racemose, subglobose, with involucre, receptacle convex, hairy, florets yellow; fruit achene, obovoid, without pappus; odor aromatic; taste very bitter; contains volatile oil 1 p. c., absinthin, anabsinthin, tannin, resin, absinthic (succinic) acid, salts, ash 7 p. c. Tonic, stomachic, stimulant, febrifuge, anthelmintic; used for atonic dyspepsia, lumbricoid worms; oil in form of *absinthe liqueur* (oil + anise oil + alcohol) as a narcotic, stimulant in cerebral exhaustion, alone locally as an anæsthetic for rheumatism, neuralgia. Dose, gr. 15–60 (1–4 Gm.); infusion, 5 p. c., 3j–2 (30–60 Cc.); tincture (diluted alcohol), 20 p. c., 3j–2 (4–8 Cc.).

FIG. 421.

*Artemisia Absinthium.*

2. *A. Abrot'anum*, *Southern-wood*, *Old Man*.—Asia, Europe; hairy, segments of the pinnatifid leaves capillaceous, lemon odor. *A. vulga'ris*, *Mugwort*, Africa, Europe, spontaneous in United States; stem purple; epilepsy, amenorrhœa. *A. gnaphalo'des* (*A. ludoricia'na* var. *gnaphalodes*), *Western Mugwort*, Mich. to Oregon; febrifuge. *A. abyssin'ica*, *Abysinia*; has woolly involucre, whitish florets; aromatic odor.

## ARNICA. ARNICA.

**Arnica**  
**montana**, Linné. } The dried flower-heads.

*Habitat.* Europe—Germany, Switzerland (Alps, Pyrenees)—N. Asia, N. W. America; in mountains and moist upland meadows.

*Syn.* Arnice Flores, U. S. P. 1890, Leopard's-bane, Wolf's-bane, Mountain Arnica or Tobacco; Br. Arnice Rhizoma; Fr. Fleurs (d'Arnique) d'Arnica, Racine d'Arnica; Ger. Flores Arnice, Arnika blüthen, Fallkraut, Arnikawurzel, Wohlverleisch (blüthen or wurzel).

**Ar'ni-ca.** L. fr. Gr. ἀρνίαις, a sheep's skin—i. e., resemblance of hairy stem and leaves; or from παταύικ [ὅς ἡ]—i. e., causing one to sneeze.

**Mon-ta'na.** L. *montanus*, mountainous, from its preferred place of growth.

**PLANT.**—Perennial herb; stem .3 M. (1°) high, hairy, striate; leaves—radical oblong-ovate, entire, ciliated, obtuse—cauline lanceolate, both kinds bright green, pubescent; rhizome 5 Cm. (2') long, 2–4 Mm. ( $\frac{1}{2}$ – $\frac{1}{4}$ ') thick, brown, wrinkled, internally whitish, bark thick, under surface with numerous roots, fragile, 10 Cm. (4') long; achenes crowded with pappus. **FLOWERS**, May–June, subglobular, yellow, 2.5–5 Cm. (1–2') broad, 2 Cm. ( $\frac{1}{2}$ ') long; involucre campanulate-turbinate, bracts in 1–2 ranks, oblong, dark green, pubescent; receptacle slightly convex, pitted, hairy, rays 16, bright yellow, the ligulate portion 2.5 Cm. (1') long, 6 Mm. ( $\frac{1}{4}$ ') broad, 3-toothed,

FIG. 422.



*Arnica montana*: 1, rhizome and stem; 2, flowering stem; 3, vertical section of disk-flower; 4, ray-floret.

7–9-nerved, pistillate; disk-florets perfect, tubular, 5-toothed, deeper yellow, their achenes 6 Mm. ( $\frac{1}{4}$ ') long, slender, tapering to base flattened, 5-ribbed, pubescent, pappus half longer than achene, of a single circle of nearly white barbellate bristles; odor characteristic, agreeable; taste bitter. *Solvents*: diluted alcohol; hot water. *Dose*, gr. 5–20 (.3–1.3 Gm.).

**ADULTERATIONS.**—Many Compositæ, as *Calendula*, *Anthemis* (both without pappus) *Inula*, *Doron'icum*, *Sene'cio* (naked receptacle), *Scorzone'ra*, and *Tragopo'gon* (florets all ligulate).

**Commercial.**—Flowers are used mostly in medicine; they lose 75 p. c. on drying, and in Germany are deprived of involucre and receptacle when intended for use in pharmacy, because these parts often are attacked by larva of the arnica-fly (*Trypet'us arniciv'ora*), an insect which should always be removed when found.

**CONSTITUENTS.**—Arnicin,  $C_{12}H_{22}O_2$ , 4 p. c., volatile oil .04–.07 p. c., resin, fat, salt.

**COMPOSITEÆ.**

**Arnica.**—A glucoside obtained by passing tincture through animal charcoal, evaporating, adding to residue ether, which dissolves arnicin and fat, and this shaken with alcohol dissolves out arnicin. It is yellow, amorphous, acrid taste, soluble in alcohol, ether, alkalis ( $\text{NH}_4\text{OH}$ ,  $\text{KOH}$ ,  $\text{NaOH}$ ,  $\text{NaHCO}_3$ ), slightly in water.

**PREPARATIONS.**—1. *Tinctura Arnicæ*. Tincture of Arnica. (Syn., *Tinctura Arnicæ Florum*, U. S. P. 1890; Fr. *Teinture (de fleur) d'Arnica*; Ger. *Tinctura Arnicæ*, *Arnikatinktur*.)

*Manufacture*: 20 p. c. Macerate 3 days, with occasional stirring, 20 Gm. with diluted alcohol 50 Cc., express strongly, repeat maceration 1 day, twice successively, with diluted alcohol 25 Cc., then macerate residual marc 6 hours with diluted alcohol q. s. 100 Cc., mix expressed liquids, filter. Dose,  $\text{Mxv}$ –45 (1–3 Cc.). If ammonia water 3j to Oij (4 Cc.–1 L.) be added to the first macerating menstruum, we get a much darker colored preparation, and one equally as efficient.

*Unoff. Preps.*: **FLOWERS**: *Fluidextract*, dose,  $\text{Mv}$ –20 (.3–1.3 Cc.). *Extract*, dose, gr. 1–3 (.06–.2 Gm.). *Infusion*, dose,  $\text{3ss}$ –1 (15–30 Cc.). *Fomentation*. **RHIZOME**: *Extract* (diluted alcohol), dose, gr. 1–3 (.06–.2 Gm.). *Fluidextract*—(alcohol 75 p. c.), dose,  $\text{Mv}$ –10 (.3–.6 Cc.). *Tincture*, 10 p. c. (alcohol 65 p. c.), dose,  $\text{Mv}$ –20 (.3–1.3 Cc.). *Decoction*, 5 p. c., dose, 3iv (15 Cc.). *Plaster*.

**PROPERTIES.**—Stimulant, tonic, carminative, diuretic, nervine, emmenagogue, irritant, sternutatory, vulnerary. Large doses emetic, cathartic, causing abdominal pains, headache, collapse, resembling aconite.

FIG. 423.

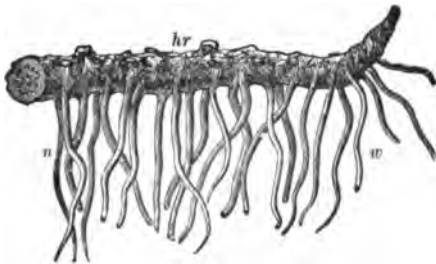
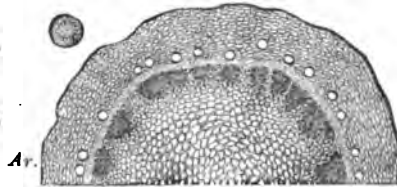
*Arnica montana*: hr, rhizome; n-w, roots.

FIG. 424.

*Arnica*: transverse section of rhizome, natural size, and magnified 12 diam.

**USES.**—Typhoid condition, brain concussion, intermittents, dysentery, diarrhœa, gout, nephritis, rheumatism, dropsy, amaurosis, chlorosis, amenorrhœa, chronic catarrh, paralysis, nervous affections. The natives of Savoy and the Vosges use the flowers and leaves as a substitute for tobacco. Locally in paralysis, sprains, bruises, abrasions, hence the German name *Fallkraut*, accident plant. Atropine best antidote.

**Allied Plants:**

1. *Arnica foliosa*, *A. alpina*, and *A. Chamisso'nis*.—California to Maine. These have flowers closely resembling the official.

## LAPPA. LAPPA.

**Arctium Lappa**, Linné, } The dried root, collected from plants of the  
and other species. } first year's growth.

*Habitat.* Europe, N. Asia, naturalized in N. America; in waste places and roadsides.

*Syn.* Burdock, Radix Bardanæ, Clotbur, Clitbur, Grass Burdock, Bardana, Beggar's or Billy-buttons, Bourholm, Clive, Burr Seed, Hardock, Hareburr, Hurr Burr, Turkey Bur Seed; Fr. Bardane, Glouteron; Ger. Klettenwurzel.

**Arctium**. L. fr. Gr. ἀρκτος, a bear—i. e., from rough involucre of flower and fruit.

**Lappa**. L. a bur, fr. Gr. λαβειν, to seize—i. e., thorny fruit holds fast to animals, clothing, etc. Burdock = Dock plant that produces a bur.

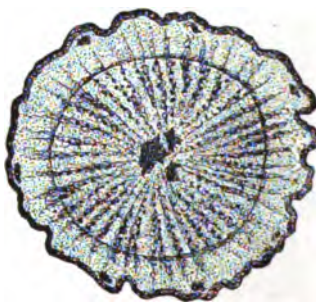
**PLANT.**—Coarse biennial weed; stem .6–2 M. (2–6°) high, branched; leaves cordate-oblong, dentate, rough, petiolate; flowers July–Sept., purple, middle-sized heads; calyx consists of imbricated scales with hooked extremities by which they adhere to objects; achenes oblong, compressed, 3-angled, ribbed; seed quadrangular. The var. *ma'jor* or *ma'jus* has broad heads, 2.5 Cm. (1') wide, smoothish involucre; var. *tomento'sum* has involucre and peduncles woolly;

FIG. 425.



Arctium Lappa.

FIG. 426.



Lappa: transverse section, magnified 2 diam.

var. *mi'nor* or *mi'nus* has heads small, involucre at first cottony, finally smooth, leaves unequally rounded at base. Root, .25–.8 M. (10–30') long, 5–20 Mm. ( $\frac{1}{5}$ – $\frac{4}{5}$ ') thick, nearly simple, fusiform, frequently split or in broken pieces, grayish-brown, longitudinally wrinkled, crown somewhat annulate, sometimes surmounted by a woolly tuft of leaf remains, fracture somewhat horny, dark cambium separating the thick brownish bark from yellowish porous radiate wood, centrally hollow or containing white pith-like tissue; odor slight; taste mucilaginous, sweetish, slightly bitter. Should be collected in autumn of the first year's growth, or early in succeeding spring, and in drying loses 85 p. c. *Solvents*: diluted alcohol; boiling water partially. Dose, 3ss–2 (2–8 Gm.).

**CONSTITUENTS.**—Inulin, bitter extractive, resin, fat 9 p. c., mucilage,

**COMPOSITÆ.**

sugar, wax, tannin (phlobaphene), lappin (crystalline glucoside, soluble in alcohol, chloroform, water), ash 3–4 p. c.

**Inulin.**—This takes the place of starch, and in fall and spring is frequently present to the extent of 45 p. c.

**PREPARATIONS.**—1. *Fluidextractum Lappæ*. Fluidextract of Lappa. (Syn., *Extractum Lappæ Fluidum*, U. S. P. 1890, Fluidextract of Burdock; Fr. *Extrait liquide de Bardane*; Ger. *Flüssiges Klettenwurzelextrakt*.)

**Manufacture:** Macerate, percolate 100 Gm. with diluted alcohol q. s., evaporate to 100 Cc. Dose, ʒss–2 (2–8 Cc.).

**Unoff. Preps.:** *Extract*, dose, gr. 5–20 (.3–1.3 Gm.). *Decoction*, dose, ʒij–4 (60–120 Cc.). *Infusion*, dose, ʒij–4 (60–120 Cc.). *Tincture*, 10 p. c. (dil. alc., whisky), dose, ʒij–3 (8–12 Cc.), after meals. *Syrup*.

**PROPERTIES.**—Diaphoretic, diuretic, alterative, aperient, depurative.

**USES.**—Rheumatism, gout, pulmonary catarrh, chronic skin diseases (psoriasis, acne), syphilis, scrofula, urinary deposits. Externally—swellings, hemorrhoids, burns, wounds, ulcers, eruptions.

**Allied Substitutions:**

1. *Fructus Lappæ*. *Semen Bardanæ*.—Seed, official 1830–1840; about 6 Mm. ( $\frac{1}{4}$ ') long, obovate-oblong, slightly curved, angular, flattened, roughish, brown-gray, mottled with black; inodorous; taste oily, bitter; contains drying oil 15.4 p. c., resins 5.5 p. c., lappin. Tincture 25 p. c. (alcohol 75 p. c.), dose, ʒss–2 (2–8 Cc.); fluidextract, ℥xv–30 (1–2 Cc., tonic); ʒss–1 (2–4 Cc., alterative).

2. *Fructus Silybi* (*Sil'ybum maria'num*), *Mary Thistle*.—S. Europe; achenes 5 Mm. ( $\frac{1}{8}$ ') long, not curved, obovate; flattened, smooth, glossy, light brown, with blackish striæ, brownish; taste oily, bitter.

3. *Xan'thium struma'rium*, *Broad Cocklebur*.—Ambrosiaceæ, N. America; achenes 2.5 Cm. (1') long, flat, oblong, without pappus, enclosed in the involucre, which is densely beset with hooked prickles.

4. *X. spino'sum*, *Spiny* or *Thorny Clobur*.—N. America, S. Europe. Leaves with spines at base 2.5 Cm. (1') long; fertile axillary burs (achenes) crowned with 1 inconspicuous beak.

5. *X. canadense*, and its var. *echina'tum*.—Achenes with 2 stout beaks, hooked, 2.5 Cm. (1') long, densely prickly, hispid; river banks, waste places; var. *echinatum*, smaller plant—possibly unworthy of variety distinction.

6. *Car'thamustincto'rius*, *Safflower*.—The dried florets, official 1820–1880, India, cultivated; in America, etc. Annual herb .3–.6 M. (1–2°) high, branched; leaves spinose; flowers orange-red, corolla tubular, 2.5 Cm. (1') long, 5-lobed, odor slight, taste bitter; contain volatile oil, carthamin (red) 0.5 p. c., saffron yellow 24–30 p. c. Diaphoretic (hot infusion), tonic, laxative for measles, scarlatina (to promote eruption), catarrh, rheumatism; in infusion. Dose, gr. 5–15 (.3–1 Gm.).



*Carthamus tinctorius.*

## RECAPITULATION No. 10.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
<i>Valerianaceæ</i> : 1. <i>Valeriana</i> . 2. <i>Valerian</i> .	<i>Valeriana officinalis</i> .	The dried rhizome and roots.	Europe, N. Asia.	Volatile oil, valeric (valerianic) formic, stearic, maleic acids, cinnamic, tannin, resin.	Fluidextract, tincture ammoniated tincture of Valerian.	Stimulant, anodyne, nervine, antispasmodic, vermifuge.	Hysteria, nervous coughs, diabetes, dropsies, morphia, phoboid dysmenorrhoea, epilepsy, flatulence.	Grains, 1-40 (1-4 Gm.).
<i>Cucurbitaceæ</i> : 1. <i>Pepo</i> . 2. <i>Pepo</i> .	<i>Cucurbita Pepo</i> .	The seed.	Tropic Asia, America.	Fixed oil, acid resin, starch, proteids.	.....	Tenifuge, vermifuge.	Tape- and lumbricoid worms.	480-960 (30-60 Gm.).
1. <i>Colocynthis</i> . 2. <i>Colocynth</i> .	<i>Citrullus Colocynthis</i> .	The peeled dried fruit.	Asia, Africa, S. Europe.	Colocynthin, colocynthin, pectin, gum.	Extr. comp. extr. pli. cathar. co., pli. cathar. veg. Triturate.	Cathartic, drastic, diuretic, emetic.	Evacuant, dropsy, apoplexy, paralysis.	2-10 (13-6 Gm.).
1. <i>Elaterium</i> . 2. <i>Elaterin</i> .	<i>Ecballium Elaterium</i> .	The neutral principle from Elaterium.	W. Asia, N. Africa, S. Europe.	$C_{40}H_{80}O_8$ .	.....	Hydragogue cathartic.	Dropsy, brain and lung congestion, uræmia.	1-2 (68-106 Gm.).
<i>Campanulaceæ</i> : 1. <i>Lobelia</i> . 2. <i>Lobelia</i> .	<i>Lobelia inflata</i> .	The dried leaves and tops.	N. America.	Lobeline, inflatin, lobelacrin, lobelle acid, resin, volatile oil.	Fluidextract, tincture.	Expectorant, emetic, nervine, purgative, narcotic.	Spasmodic asthma, catarrh, bronchial spasms, whooping-cough.	1-20 (06-1.8 Gm.).
<i>Chenopodiaceæ</i> : 1. <i>Taraxacum</i> . 2. <i>Taraxacum</i> .	<i>Taraxacum officinale</i> .	The dried root.	Europe.	Inulin, pectin, milk-juce, taraxacrin, resin, taraxacrin.	Extract, fluid-extract.	Diuretic, tonic, aperient, deobstruent.	Liver affections, dyspepsia, constipation, ærzenia, dropsies.	30-120 (2-8 Gm.).
1. <i>Lactucarium</i> . 2. <i>Lactucarium</i> .	<i>Lactuca virosa</i> .	The concrete milk-juice.	C. and S. Europe.	Lactucin, lactucic acid, lactucoplerin, lactucerin, volatile oil, asparagin, caoutchouc.	Tincture, syrup.	Anodyne, sedative, hypnotic, expectorant.	Insomnia, cough, dropsy, heart-trouble, nervousness, intermittents.	1-8-15 (06-5-1 Gm.).
<i>Compositæ</i> : 1. <i>Eupatorium</i> . 2. <i>Eupatorium</i> .	<i>Eupatorium perfoliatum</i> .	The dried leaves and flowering tops.	N. America.	Eupatorin, volatile oil, resin, tannin.	Fluidextract.	Stimulant, tonic, diaphoretic.	Intermittents, muscular rheumatism, bronchitis, dyspepsia.	30-60 (2-4 Gm.).

1. Grindella. 2. Grindella.	Grindella : robusta, squarrosa.	The dried leaves and flowering tops.	N. America.	Volatile oil, resin, bitter principle, grinde-line, fat.	Fluidextract.	Sedative, tonic, antispasmodic.	Asthma, bronchitis, catarrhs, whooping-cough, rheumatism, burns, blisters.	15-60 (1-4 Gm.).
1. Oleum Erigerontis. 2. Oil of Erigeron.	Erigeron canadense.	Volatile oil from the flowering herb.	N. America.	Limonene, $C_{10}H_{16}$ , + oxygenated compound.	.....	Stimulant, tonic, diuretic, styptic.	Diarrhea, hemorrhages, gravel, dropsy.	Minims. 5-10 (3-6 Cc.).
1. Calendula. 2. Calendula.	Calendula officinalis.	The dried ligulate florets.	S. Europe, Levant.	Volatile oil, calendulin, bitter principle, gum.	Tincture.	Stimulant, tonic, febrifuge, anthelmintic.	Jaundice, amenorrhea, fevers, scrofula, ulcers, cancers, sprains, bruises, wounds.	15-60 (1-4 Gm.).
1. Anthemis. 2. Anthemis.	Anthemis nobilis.	The dried flower-heads.	S. and W. Europe.	Volatile oil, anethemene, anethemic acid, resin, tannin.	.....	Stimulant, tonic, nervine, carminative, emmenagogue.	Indigestion, debility, intermittents, torpid liver, delirium tremens, sprains, tooth-ache, colic, ulcers, rheumatism.	15-60 (1-4 Gm.).
1. Matricaria. 2. Matricaria.	Matricaria Chamomilla.	The dried flower-heads.	Europe, W. Asia.	Volatile oil, anethemic acid, anethimidin, tannin.	.....	Stimulant, tonic, nervine, carminative, emmenagogue.	Indigestion, convalescence, intermittents, delirium tremens, abscesses, colic, tooth-ache, rheumatism, sprains.	15-60 (1-4 Gm.).
1. Pyrethrum. 2. Pyrethrum.	Anacyclus Pyrethrum.	The root.	N. Africa.	Pyrethrine, volatile oil, inulin, tannin.	Tincture.	Irritant, rubefacient, sialogogue, sternutatory.	Headache, rheumatism, toothache, tongue paralysis, catarrh, neuralgia.	30-60 (2-4 Gm.).
1. Santonica. 2. Santonica.	Artemisia pauciflora.	The dried unexpanded flower-heads.	N. Turkey.	Santonin, volatile oil, resin, gum.	Santonin : troches.	Anthelmintic, stimulant, emmenagogue.	Round and thread-worms, incontinence of urine, eye affections.	15-60 (1-4 Gm.).
1. Arnica. 2. Arnica.	Arnica montana.	The dried flower-heads.	Europe, N. Asia.	Arnica, volatile oil, resin, salts.	Tincture.	Stimulant, tonic, carminative, diuretic, emmenagogue, irritant.	Typhoid, intermittents, diarrhea, dysentery, gout, nephritis, aneurisms, amenorrhea, rheumatism, dropsy, catarrh, paralysis, nerve.	5-20 (3-13 Gm.).
1. Lappa. 2. Lappa.	Arctium Lappa.	The dried root.	Europe, N. Asia.	Inulin, resin, bitter, extractive, fat, glucoside.	Fluidextract.	Diaphoretic, diuretic, alterative, aperient.	Rheumatism, catarrhs, skin diseases, syphilis, scrofula, burns, ulcers, wounds.	30-120 (2-8 Gm.).





## PART II.

### ORGANIC DRUGS FROM THE ANIMAL KINGDOM.

THE ANIMAL KINGDOM is divided into two great subkingdoms, viz. :

I. Invertebra'ta. L. fr. *in*, not, + *vertebratus*, vertebrated—*i. e.*, not vertebrated. These have no vertebra, backbone, or spinal column.

II. Vertebra'ta. L. fr. *vertebratus*, jointed, articulated—*i. e.*, vertebrated. These have a backbone (spinal bone) surrounding, and thus protecting, the spinal cord, often called conjointly spinal column.

#### SUBKINGDOM I. INVERTEBRATA.

CLASS 1. : INSECTA. L. pl. of *insectum*. This class includes those small animals that have 1 pair of antennæ, 3 pairs of mouth organs, and breathe air by means of tracheæ, opening by spiracles along the sides of the body, as hexapods (6-legged) and myriapods (many-legged).

##### 1. HEMIPTERA. Hemipterous Family.

He-mip'te-ra. L. neut. pl. of *hemipterus*, half-winged, fr. Gr. *ἡμι*, half, + *πτερόν*, wing—*i. e.*, insects have forewings partly membranous and partly coriaceous, chitinous. This family includes the various kinds of bugs; they are hexapod insects, having a jointed proboscis, including 4 sharp stylets (mandibles and maxillæ) for piercing and sucking; have no sucking stomach. They feed upon plant-juices or animal blood. The metamorphosis is mostly incomplete; the molt is, as a rule, repeated 4 times, the stage next to the last, preceding the imago, being called pupa. Includes squash-bug, soldier-bug, bed-bug, cicadas, cuckoo, spites, plant lice, scale insects, thrips, lice.

Genus : 1. *Pseudococcus*.

#### COCCUS. COCHINEAL.

*Pseudococcus*  
*cacti*, (Linné) Burmeister. } The dried female insect.

*Habitat.* Mexico, C. America; cultivated in W. Indies, Canaries, Algiers, S. Spain.

*Syn.* Cochineal Insect; Fr. Cochenille; Ger. Coccionella, Scharlachwurm.

*Pseu-do-coc'cus*. L. fr. Gr. *ψευδής*, false, + *κόκκος*, a grain, berry, kernel—*i. e.*, from the resemblance of the insect.

*Coc'ti*. L. gen. of *cactus*, fr. Gr. *κάκτος*, a prickly plant—*i. e.*, insects feed upon *Cactus* species.

*Coc'cus*. L. fr. Gr. *κόκκος*, a grain, berry, kernel—*i. e.*, from the insect resemblance.

*Coch'i-ne-al*. L. fr. *cochinilla*, L. *coccineus*, scarlet, *coccum*, a berry—*i. e.*, which the kermes insect resembles, and was once supposed to be.

**INSECT.**—The female when full-grown is 8 Mm. ( $\frac{1}{3}$ ') long, 6 Mm. ( $\frac{1}{4}$ ') high, when dry 5 Mm. ( $\frac{1}{3}$ ') long, somewhat oblong, angular, flat and concave beneath, convex above, purplish-gray or purplish-black, transversely wrinkled, easily pulverizable into dark red powder; odor faint; taste slightly bitter; coloring matter soluble in water, alcohol, ammonia water, slightly in ether, insoluble in fixed and volatile oils; alkalies change color to purple. Dose, gr. 1–15 (.06–1 Gm.).

FIG. 428.

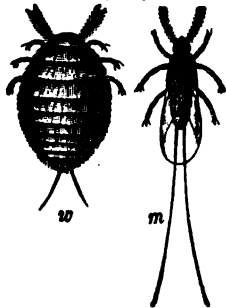


*Pseudoroccus cacti*, female insect, natural size: a, before, and b, c, after impregnation, dry, and soaked in water.

**ADULTERATIONS.**—I. **SILVER-GRAIN:** Barium and lead carbonates or sulphates, talcum, etc. II. **BLACK-GRAIN:** Graphite, ivory black, manganese dioxide. III. **FACTITIOUS:** Artificial product made of starch, gum, mineral and coloring matters; also prepared by coloring exhausted cochineal powder with rosaniline, and granulating; recognized by readily forming paste with water. **Tests:** 1. Macerate in water, when the powder separates, the minerals depositing; or burn insects and note the increased ash yield—12–35 p. c. 2. Cold decoction is decolorized by potassium permanganate, preferably in the presence of a little indigo carmine.

**Commercial.**—Female is official, being twice the size of the male, has a rostrum, bluish-red body, underside flat, upper convex, no wings or bristles, both of which the male possesses. These feed upon Cactus species, and especially on *Nopa'lea cochenil' lifer* (*Opun'tia coccinellif'era*); the females attach themselves to the plant, remaining continuously at one point, where they copulate, increase much in size, and the several thousand eggs hatch by the sun within the body after death—the body being concealed by a white wax, in the form of a fluffy, cotton-like mass. In Mexico, during the rainy seasons, insects are kept on cactus branches under roof, and in good weather are *sown* upon plants, the young ones allowed to develop until females become fecundated and enlarged, when they are brushed from the branches into hot water, thereby removing the wax; thus killed they are then dried by sun or fire, giving *black-grain cochineal*; if they are killed and dried simply by exposure to sulphur fumes or direct heat of sun or ovens, the wax is retained, giving *silver-grain cochineal*. Some females are always left for propagation, which often yield 3 harvests before a return of rainy season; the *granilla* or *grana sylvestra* is an inferior variety, composed of smaller and uncultivated insects.

FIG. 429.



Cochineal insects, magnified 3 diam.: w, female; m, male.

**CONSTITUENTS.**—Carminic acid,  $C_{17}H_{18}O_{10}$ , 10 p. c., Coccerin (wax),  $C_{30}H_{60}(C_{31}H_{61}O_3)_2$ , 1–2 p. c., fixed oil 4–6 p. c., myristin 1.5–2 p. c., fats, gum, volatile oil, ash 3–6 p. c.

**Carminic Acid.**—This is the coloring matter, being obtained by macerating in ether, treating residue successively with boiling alcohol, from which it deposits upon cooling and spontaneous evaporation; it

**HEMIPTERA.**

is brownish-purple, yielding red powder, soluble in water, alcohol, alkalies, precipitated purple by earths, insoluble in fixed and volatile oils. When boiled with diluted sulphuric acid splits into sugar and carmine-red,  $C_{11}H_{12}O_7$ , a vermilion-red powder, soluble in water, alcohol, and alkalies.

Watery infusion or decoction of cochineal is violet-crimson, brightened by acids, deepened by alkalies; with it zinc, bismuth, and nickel salts give lilac precipitates; iron salts a dark purple or black; tin salts (nitrate, chloride) a brilliant scarlet; alumina a pigment called *lake*, while that precipitated by acids, animal gelatin, (salts of tin), alum, cream of tartar, or salt of sorrel, is *carmine*, which contains coloring matter (carminic acid) 50–60 p. c., but often is adulterated with vermilion, lead dichromate, and starch, sometimes as much as 60–70 p. c. *Test*: 1. Pure carmine should be entirely soluble in ammonia water, and yield ash 9 p. c.

**PREPARATIONS.**—1. *Tinctura Cardamomi Composita*,  $\frac{1}{2}$  p. c.

*Unoff. Preps.*: *Tinctura Cocci* (Br.), 10 p. c. (alcohol 45 p. c.), dose,  $\text{Mv}$ –30 (.3–2 Cc.). *Infusion (Infusum Cocci)*, dose,  $\text{3ss}$ –1 (15–30 Cc.).

**PROPERTIES.**—Stimulant, antispasmodic, diuretic.

**USES.**—Whooping-cough, neuralgia, chiefly for its coloring properties, especially carmine; in tinctures; tooth powders, etc.

*Allied Insects*:

1. *Pseudococcus ili'cis*.—Greece (Morea, mountains); inhabits *Quercus coccif'era*; consists of females, size of a pea, brownish-red; used natively as a dye, and called *kermes*, *chermes*, or *alkermes*; with tin salts gives scarlet-red precipitate like coccus.

2. *Spon'gia officina'lis*, *Sponge*.—*Ceratospongiæ*. The fibrous framework, official 1820–1850. In seas, attached to rocks, sometimes planted. Animal, the lowest order living in water, composed of amoebiform bodies disposed about a common cavity, with one or more breathing orifices through which water flows in and out. We use the fibrous framework from which the animalcules (gelatinous matter or flesh), gritty and sandy parts have been washed. Sponges are torn from rocks by hands or forks, buried in sand several days to disintegrate animal matter, soaked in water, squeezed, and washed. We have several varieties: 1. Mediterranean, Turkey. 2. Zimocca (coast of Greece). 3. Bathing (N. Africa). 4. Sheeps' Wool (Bahama, Florida, Nassau). These are yellowish-brown, but are bleached by sulphur dioxide, chlorine, sulphurous acid solution, or dipping into 2–3 p. c. solution of potassium permanganate, washing in 2–3 p. c. solution of oxalic acid. Sponge contains spongin, also NaCl,  $\text{CaCO}_3$ , Mg, Si, Fe, S, P, Br, I, K, ash 3–4 p. c. Used mechanically for cleansing, washing, absorbing liquids, dilating cavities (sponge tents), supporting parts (pessaries) in dysmenorrhœa, to cause premature labor. When compressed usually coated with wax to prevent absorbing moisture, hence expansion.

*Spongia Usta*, *Burnt Sponge*.—Official 1820–1860. Heat sponge in a coffee-roaster until weight is one-fourth less; the residue is mostly charcoal, while 30–35 p. c. is the part used, consisting of calcium sulphate 25–30 p. c., silica 10 p. c., ferrous oxide 9 p. c., also magne-

sium carbonate, potassium chloride, calcium phosphate, and sodium iodide 2 p. c. Now superseded by iodine.

3. *Sanguisuga medicina'lis*, and *S. officina'lis*, *Hirudo*, *Leeches* (Br.).—Annulata. 1. C. and N. Europe (Swedish, German Leech). 2. S. Europe (Hungarian Leech); in fresh-water ponds. These animals are 7.5–15 Cm. (3–6') long, smooth, soft, round, flattened, composed of 90–100 rings, disk at each end, in the centre is the mouth, containing 3 jaws, having many teeth; back olive-green with 6 reddish stripes dotted with black, belly greenish, sides black-spotted or with a black line. The first withdraws a quantity of blood equal to its weight, the second more, while a still larger quantity flows after leech falls off. They may be made to disgorge the blood by being placed in a solution of salt, although they should not be used again within 6 months. Used for local depletion.

*Calcareous Related Products:*

1. *Os'trea virginia'na* and *O. ed'ulis*, *Testa*, *Oyster-shell*.—Monomya. The inner white layer of the shell, official 1830–1880. Atlantic and Indian Ocean coasts. Animal has soft, fleshy, suborbicular body, enclosed in a calcareous shell opening by a hinge at one end into 2 valves (bivalved), the deeper one adhering to a rock, etc. Shell is rough, gray outside; inside white, glossy, smooth. For medicine (*testa præparata*) they are boiled, outside layer removed and inside one powdered, separating coarse particles by elutriation; contains calcium carbonate 88–98 p. c., calcium phosphate and sulphate, also Mg, Al, Si,  $\text{Fe}_2\text{O}_3$ . Used as antacid for diarrhœa, chronic bowel affections. Dose, gr. 5–30 (.3–2 Gm.).

2. *Oculi'na virgin'ea* and *Coral'lum ru'brum*, *Corallium*, *Coral*.—Hexa (Octo)-coralla. Mediterranean Sea, Atlantic Ocean. Polypipherous animals having a skeleton and a fleshy portion. The calcareous skeleton is branched like a shrub, and on these branches are the individual animals in tube-like apertures; skeleton is used in medicine; occurs in hard, cylindrical, branching pieces, porous, striate surface, radiating interior, often hollow, inodorous, tasteless, white (first) or red (second); contains animal matter 8 p. c.,  $\text{CaCO}_3$  83 p. c.,  $\text{MgCO}_3$  3.5 p. c.,  $\text{Fe}_2\text{O}_3$  (red coral) 4.25 p. c. Used in tooth powders and as antacid. Dose, gr. 5–30 (.3–2 Gm.).

3. *Se'pia officina'lis*, *Os Sepiæ*, *Cuttle-fish Bone*.—Decapoda. Mediterranean, Atlantic Ocean. A calcareous substance under the skin of the back of the cuttle-fish, often found floating in the water; occurs 12.5–25 Cm. (5–10') long, 2.5–7.5 Cm. (1–3') wide, outside hard, smooth; inside porous, friable, inodorous, taste saline; contains  $\text{CaCO}_3$  80–85 p. c., NaCl, MgO,  $\text{Ca}_3(\text{PO}_4)_2$ . Used as antacid like chalk, oyster-shell, etc., also in tooth and polishing powders, chiefly now for caged birds to rub their bills against.

4. *As'tacus fluviat'ilis*, *Crawfish*.—Decapoda. Russia. The stomach of this contains concretions known as *calculi (lapides) cancrorum*, *crabs' eyes* or *stones*, which are obtained by washing putrefied animals. These are circular, 3–10 Mm. ( $\frac{1}{8}$ – $\frac{2}{5}$ ') broad, plano-convex, white, hard, in-

**COLEOPTERA.**

odorous, tasteless; contain animal matter 12–15 p. c., calcium carbonate 63 p. c., calcium phosphate 17 p. c. Used as antacid. Dose, gr. 5–30 (.3–2 Gm.).

**2. COLEOPTERA. Coleopterous Family.**

**Ko-le-op'te-ra.** L. pl. of *coleopterum*, fr. Gr. *κολέος*, a sheath, + *πτερόν*, a wing—*κολόπτερος*, sheath-winged—*i. e.*, insects having the posterior pair of wings membranous and sheathed by the hardened anterior pair, called *elytra*, which, when folded together, usually form a nearly complete covering of the body. This family includes the beetles and weevils, all of which not only have their 2 pairs of wings arranged as above described, but have their mouth parts, forming 2 pairs of jaws (mandibles and maxillæ), adapted for chewing. The larva is variable, having 6 legs or none, no prolegs, pupa inactive; metamorphosis is complete.

Genus: 1. **Cantharis.**

**CANTHARIS. CANTHARIDES.**

**Cantharis** { The beetle, thoroughly dried at not exceeding 40°  
**vesicatoria**, *De Geer.* { C. (104° F.).

*Habitat.* S. and C. Europe, W. Asia.

*Syn.* Spanish Flies (Fly), Blister Beetle, *Musca Hispanica*, *Lytta vesicatoria*; Fr. *Cantharides*; Ger. *Cantharides*, *Spanische Fliegen*, *Canthariden*, *Kanthariden*.

**Can'tha-ris.** L. pl. *cantharides*, a beetle, fr. Gr. *κάνθαρις*, a beetle, Spanish fly—*i. e.*, the classic name.

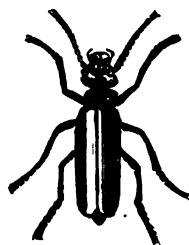
**Ves-i-ca-to'ri-a.** L. *vesica*, a blister, of or belonging to or capable of blistering.

**INSECT.**—18–25 Mm. ( $\frac{3}{4}$ –1') long, 6 Mm. ( $\frac{1}{4}$ ') broad, flattish-cylindrical, antennæ filiform, black in upper part, with 2 long wing-cases (-sheaths), and ample, membranous, transparent brownish wings, elsewhere of a shining coppery-green color; powder grayish-brown, containing green, shining particles, few or no hairs; odor strong, disagreeable; taste slight, afterward acrid. *Solvents*: alcohol; chloroform. Dose, gr.  $\frac{1}{8}$ –1 (.01–.06 Gm.).

**ADULTERATIONS.**—**BEETLE**: Other beetles easily recognizable, exhausted flies, beads, etc.; **POWDER**: Ground euphorbium (gumresin), etc.; all detected by diminished yield of cantharidin and increased amount of ash, which should not exceed 8 p. c.

**Commercial.**—Spanish flies are mostly from Spain, Italy, Sicily, S. France, Hungary, S. Russia; their odor is penetrating, resembling that of mice, by which their approach in swarms can easily be recognized; they attach themselves to trees and shrubs chiefly of the *Oleaceæ* and *Caprifoliaceæ*, as ash, white poplar, privet, lilac, elder, honeysuckle, etc. Upon these they swarm in May–July, when persons masked and gloved go at early morn to collect them, they being then more or less stupefied from night-coldness. After spreading cloths the trees are shaken or beaten with poles; the beetles are gathered up and plunged into hot water or diluted vinegar, or exposed to vapors of either vinegar, chloroform, ether, oil of turpen-

FIG. 430.

*Cantharis vesicatoria.*

tine, ammonia, or carbon disulphide. Thus killed they are spread out, dried by sun or ovens, and packed in boxes or casks for market. Russian flies enter commerce via Moscow, Hamburg, and St. Petersburg, in barrels, the best in paper-lined boxes, are copper-colored, larger, and more esteemed than those of S. Europe. All blistering beetles should be kept dry, in air-tight vessels, with a little camphor, chloroform, ether, oil of turpentine, benzene or carbon disulphide, which protects them from ravages of mite larva, etc.

**CONSTITUENTS.**—Cantharidin,  $C_{10}H_{12}O_4$ , 0.4–1 p. c., fat, inert oil (soluble in alcohol), yellow viscid matter (soluble in water and alcohol), volatile principle (giving the odor), yellow substance (soluble in ether, alcohol), black extractive, chlorophyll, phosphates of calcium, magnesium, formic, acetic and uric acids, ash 6–8 p. c.

**Cantharidin.**—Obtained by exhausting with chloroform, evaporating spontaneously; these crystals have fat and coloring matter adhering, which are removed by carbon disulphide. Occurs in colorless, odorless, tasteless prisms, soluble in hot alcohol, ether, chloroform, fats, volatile oils, glacial acetic acid, sparingly in water, cold alcohol, sublimable, with alkalies yields cantharidates; cantharidin is the blistering principle, and resides mostly in soft parts.

**Valuation.**—Exhaust with chloroform containing some hydrochloric acid or acetic ether, evaporate, deprive of fat and color by carbon disulphide; should yield cantharidin 0.4–0.7 p. c.

**PREPARATIONS.**—1. *Ceratum Cantharidis*. Cantharides Cerate. (Syn., Br. *Emplastrum Cantharidis*, Blistering Cerate (Plaster); Fr. *Emplastrum Vesicans*, *Emplâtre (vésicatoire) de Cantharides*; Ger. *Emplastrum Cantharidum ordinarium* (vesicatorium), *Spanischfliegenpflaster*, *Blasenpflaster*.)

**Manufacture:** Macerate 48 hours cantharides 32 Gm. in liquid petrolatum 15 Gm., then add this to rosin 18, yellow wax 18, lard 17, previously melted and strained; keep in a liquid over water-bath, stirring occasionally for an hour, remove and stir until it begins to congeal.

2. *Tinctura Cantharidis*. Tincture of Cantharides. (Syn., Tincture of Spanish Flies; Fr. *Teinture de Cantharides*; Ger. *Tinctura Cantharidum*, *Spanischfliegentinktur*.)

**Manufacture:** 10 p. c. Percolate 10 Gm. with alcohol q. s. 100 Cc. Dose, m̄j–20 (.06–1.3 Cc.).

3. *Collodium Cantharidatum*, 60 p. c.

**Unoff. Preps.:** *Emplastrum Calefaciens* (Br.), cantharides 4 p. c. +. *Liquor Epispasticus* (Br.—acetic ether), 50 p. c. *Unguentum Cantharidis* (Br.), 10 p. c.

**PROPERTIES.**—Diuretic, aphrodisiac, emmenagogue, rubefacient, vesicant, acrid poison. Blisters (blebs) are for stimulation, but may produce constitutional symptoms, and if allowed to remain on long they depress according to amount of serum discharged, which contains equal quantities of albumin and blood. Absorbed rapidly into the blood and eliminated by the kidneys with marked irritation. Locally causes in 2–3 hours tingling, burning pain, vascular dilatation, and reflexly dilates deep-seated bloodvessels.

## COLEOPTERA.

**USES.**—Hectic fever, dropsy, bronchitis, skin diseases, bladder weakness, gleet, vesical catarrh, diabetes, amenorrhœa, seminal emissions, gonorrhœa, menorrhagia; externally—blisters stimulate the whole or part of the system, prevent accumulation of inflammatory exudations, recall suppressed discharges, are depletory, and thus relieve internal congestions. Applied for ulcers, fistulæ, psoriasis, lupus, erysipelas, boils, alopecia, brain congestion and dropsy, hemorrhage, hydrocele, pleurisy, gleet (under the penis), leucorrhœa (sacrum), dysmenorrhœa, buboes, abscesses, typhus, typhoid fever, apoplectic condition, inflamed eyes (back of ears), pneumonia, pericarditis, phlebitis, bowel fluxes, rheumatism, neuralgia, spinal irritation, convulsions, tetanus, meningitis, wasting away of muscles, vomiting.

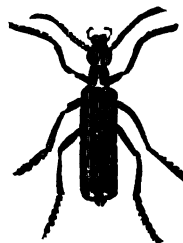
Blisters should remain on 4–8 hours, or until skin vesicated; this is aided by previously washing the affected part with soap and applying vinegar. If the spot is to be healed at once, cut off cuticle, absorb serum, which is clear, apply pledget of borated cotton and bandage; if the sore is to be prolonged, remove cuticle, apply simple cerate for one day, then basilicon ointment until discharge is purulent, after which continue as long as desired with savine or mezereum ointments. In young persons intractable sores are easily produced by blisters, and in old persons gangrene, hence they should be applied to both with moderation; when such conditions have been produced Goulard's cerate is valuable. Strangury may be avoided by sprinkling plaster with spirit or powdered camphor, sodium bicarbonate, or even powdered cantharides. The tincture is the internal preparation, and the one used in hair lotions.

**Poisoning:** Have violent gastro-enteritis, abdominal tenderness, burning in pharynx and œsophagus, burning pain in back, bladder, and urethra, constriction of throat, great desire to urinate, but urine scanty, mixed with blood and albumin, and passed with pain, vomiting, bloody stools, depression preceded by increased heart force and rapidity, strangury, swollen genitals, increased sexual desire, abortion, convulsions, coma, death. Give vegetable emetics, mucilaginous drinks freely—barley water, flaxseed tea, but not oils or oily emulsions, as these favor solubility and absorption of cantharidin; stimulants (brandy, ammonia, strychnine, atropine), warm baths, and cataplasms to abdomen, opium by mouth, and enema (for pain and gastro-enteritis).

*Allied Insects:*

1. *Cantharis vitta'ta*, *Potato Fly*.—Official 1820–1860. United States. Smaller than official, but the two resemble; thorax and wing-cases black, the latter with yellow margin and middle stripe, making 3 yellow bands, head light red with dark spots on top, abdomen and legs covered with cinereous down 12 Mm. ( $\frac{1}{2}$ ') long. This beetle inhabits Irish or white potato vines, July–Aug., morning and evening, hiding in the soil during hot hours of the day. Collect by shaking into boiling water; contains cantharidin 1.3 p. c. Used as vesicant like *C. vesicatoria*.

FIG. 431.

*Cantharis vittata.*



2. *C. cine'rea* (American; black, closely punctured, covered with ash-gray hairs); *C. margina'ta* (elytra black, margin ash-colored), *C. atra'ta* (black, 8 Mm. ( $\frac{1}{3}$ ') long), and *C. Nuttal'li*, (Kansas, California; resembles official); wing-cases golden-purple striped with green.

3. *Myl'abris cicho'rii*, and *M. phalera'ta*, *Chinese Blistering Flies*.—S. and E. Asia. Black wing-cases with 2 orange-yellow bands, and at base 2 yellow spots; powder, blackish-gray, with no glossy-green particles; contains 1–1.7 p. c. cantharidin.

FIG. 432.

*Mylabris cichorii*.

Our Pharmacopœia recognizes only 2 insects, cantharis and coccus, while a few countries accept some others, thus: 1. *Formi'ca ru'fa*, *Red Ant*. Used in Germany in spirit and tincture (Tinctura Formicarum—2 parts + alcohol 3) for rheumatism, gout, paralytic affections. Dose, ℥xv–30 (1–2 Cc.). 2. *Blat'ta orienta'lis*, *Cockroach*. Asia. Blackish, 2.5 Cm. (1') long, broad, flat, habits nocturnal; odor disagreeable. Oily decoction used for warts, ulcers, boils, scaly eruptions; internally for dyspnœa, dropsy, albuminuria, diuretic. Dose, gr. 4–5 (.3 Gm.), per die. 3. *Æ'nas a'fer*. Spain. Has advantages over cantharides in being cheaper, equally powerful, acts without pain, non-irritating to urinary organs.

### 3. HYMENOPTERA. Hymenopterous Family.

Hi-me-nop'te-ra. L. neut. pl. of *hymenopterus*, fr. Gr. ὑμενόπτερος, membrane-winged—δέρν, membrane, + πτερόν, wing—i. e., animals have membranous wings. This family includes the highest insects, because of their superior structural development, instinctive faculties, and social qualities. They have 4 membranous wings, the anterior pair being the larger, with a thickened dark spot on their front side, few reticulations; the tarsi 4–5-jointed; the tongue or lingua is converted into an organ for sucking honey, liquid food, etc., and the mandibles are adapted to biting or cutting. In bees, wasps, and ants the multivalve ovipositor of the female (workers) is modified into a sting.

Genus: 1. **Apis**.

#### APIS MELLIFERA. THE HIVE OR HONEY BEE.

1. MEL. Honey.

2. CERA FLAVA. Yellow Wax.

**Apis mellifera**, (Linné). { 1. A saccharine secretion deposited in the honey-comb by this bee. 2. A solid substance prepared from the honey-comb of the bee.

*Habitat*. N. America, Europe.

*Syn*. 1. Fr. Miel; Ger. Honig. 2. Beeswax, Yellow Wax (Beeswax), Cera Citrina; Fr. Cire jaune; Ger. Cera flava, Gelbes Wachs.

**Apis**. L. a bee, Gr. ἐμπίς, a giant—i. e., from its classical name.

**Mel-lif'e-ra**. L. *mellifer*, honey-producing, fr. *mel*, *mellis*, honey, + *ferre*, to bear.

**ANIMAL**.—This is the ordinary honey bee, which has from the earliest times been hived for its honey and wax. It lives in swarms

**HYMENOPTERA.**

of 10,000–50,000 individuals, which consist of 3 kinds or classes of bees, perfect females (queen bees), undeveloped females (neuters or working bees), and males (drones). In each swarm there is only one queen bee; she is much larger than the other bees, and her sole function is to propagate, laying about 2,000 eggs daily; when she dies a young (3 days old) working bee is selected, its cell enlarged, its food changed to royal jelly or paste—thus it soon grows into a queen; there are also several hundred drones, whose office it is to impregnate the queen, after which they are destroyed by the neuters; these last being numerous, are the laborers that suck the honey from the flowers with their proboscides, swallow it with their mouths, disgorge it into the honey-cells, and thus feed the other bees, also the young; the pollen which attaches itself to them is utilized as bee-bread for the larva, while adults feed on honey. At one time wax was supposed to be formed from pollen, but now is considered a secretion from the honey. The neuters have stings.

**I. MEL, HONEY.**—This is a syrupy liquid, yellowish-brown, translucent when fresh, gradually becoming opaque and crystalline, sp. gr. 1.370, slightly acid, usually levogyrate, characteristic aromatic odor, sweet, acrid taste. The honey from hives which have never swarmed is virgin honey; the finest is allowed simply to drain from the comb, while impure grades are obtained by pressure. *Impurities.*—Chlorides, sulphates, glucose, cane sugar, starch, inorganic substances—all increase amount of ash.

**CONSTITUENTS.**—Grape-sugar or dextrose (becoming crystalline) 32–42 p. c., fruit-sugar or levulose (remaining liquid) 32–42 p. c., wax, volatile oil, proteids, mucilage, coloring matter, formic acid, ash 0.1–0.3 p. c., usually suspended pollen grains.

**PREPARATIONS.**—1. *Mel Depuratum.* Clarified honey. (Syn., Mel Despumatum, U. S. P. 1890; Fr. Miel déspumé, Mellite simple, Sirop de Miel; Ger. Gereinigter Honig.)

*Manufacture:* Mix honey with 2 p. c. washed paper-pulp, heat on water-bath until scum ceases to rise, add distilled water q. s. for loss, strain, add glycerin 5 p. c. Dose, *ad libitum*.

*Preps.:* 1. *Mel Rosæ*, 88 p. c. 2. *Confectio Rosæ*, 12 p. c. 3.

*Hydrargyrum Cum Creta*, 10 p. c. 4. *Massa Ferri Carbonatis*, 38 p. c.

*Unoff. Prep.:* *Oxymel* (Br.) (clarified honey 8, acetic acid 1, water 1)—sometimes used in cough mixtures, dose ʒj–2 (4–8 Cc.).

**PROPERTIES AND USES.**—Demulcent, laxative; externally stimulant, nutritive, relieves dryness of mouth, facilitates swallowing; in gargles for aphthæ, thrush, pseudomembranous deposits; in poultices for boils, carbuncles, fissures of nipples; in plasters for drying up mammary secretion.

**II. CERA FLAVA, YELLOW WAX.**—The honeycomb, after draining the honey, is melted in water, impurities allowed to subside, then cooled; a second or third melting produces each time a purer product. It is a yellowish to brownish-yellow solid, agreeable, honey-like odor, faint balsamic taste, sp. gr. 0.951–0.960, when cold somewhat brittle,

fracture dull, granular, not crystalline, by heat of hands plastic, insoluble in water, soluble in ether, chloroform, fixed and volatile oils, also in benzene and carbon disulphide at 30° C. (86° F.), boiling alcohol (dissolving cerotic acid and portion of the myricin).

*Impurities.*—Fats, fatty acids, Japan wax, resin, soap, paraffin, ceresin.

**CONSTITUENTS.**—Hydrocarbons,  $C_{27}H_{56}$  and  $C_{29}H_{58}$ , 12–14 p. c., cerin or cerotic acid,  $C_{27}H_{54}O_2$ , crystallizes from boiling alcohol; myricin or myricyl palmitate,  $C_{30}H_{61}C_{16}H_{31}O_2$  (principal constituent, acicular crystals, soluble in hot ether), an alcohol,  $C_{25}H_{52}O$ , ceryl alcohol,  $C_{27}H_{56}O$ .

**PREPARATIONS.**—1. *Cera Alba*. White Wax. (Syn., White Beeswax; Fr. Cire blanche; Ger. Cera alba, Weisses Wachs.)

*Manufacture:* Yellow wax is bleached by exposure, in thin sheets, to moisture, air, and sunlight. It is yellowish-white, solid, somewhat translucent in thin layers, faint, characteristic odor, nearly tasteless, sp. gr. 0.950–0.960, melts at 65° C. (149° F.).

Preps.: 1. *Ceratum*, 30 p. c. 2. *Ceratum Camphoræ*, 35 p. c.

3. *Unguentum*, 20 p. c. 4. *Unguentum Aquæ Rosæ*, 12 p. c.

2. *Ceratum Cantharidis*, 18 p. c. 3. *Ceratum Resinæ*, 15 p. c. 4. *Ceratum Resinæ Compositum*, 22.5 p. c. 5. *Unguentum Picis Liquidæ*, 15 p. c.

**PROPERTIES AND USES.**—Mostly as bases for plasters, cerates, ointments; formerly in diarrhœa, dysentery, rheumatism, gleet, neuralgia; locally as a protective from cold and to aid cutaneous transpiration.

## SUBKINGDOM II. VERTEBRATA.

**CLASS 2: PISCES.** L. pl. of *piscis*, a fish. This class includes the oviparous animals that have fins and a covering of scales or plates. They breathe by gills, live almost entirely in water, swim instead of walking or flying, have a complete cranium, and a lyriiform shoulder girdle.

### 4. TELEOST(EÆ)-IA. Teleostean Family.

Tel-e-os'te-e. L. *teleosteus*, fr. Gr. *τέλειος*, complete, + *οστέον*, a bone—i. e., has a well-ossified skeleton, like ordinary fishes. This family has well-developed brain, optic nerves cross each other, but without any chiasm; heart has a non-contractile arterial bulb, fins have well-developed and distinct rays; skeleton is completely ossified, the backbone being composed of well-ossified vertebræ.

Genus: 1. *Gadus*.

### OLEUM MORRHUÆ. COD-LIVER OIL.

*Gadus Morrhua*, Linné, } A fixed oil from the fresh livers.  
and other species.

*Habitat.* N. Atlantic Ocean.

*Syn.* The Cod, Oleum Jecoris Aselli, Oleum Hepatis Morrhuæ, Cod Oil; Fr. Huile de Foie de Morue, Huile de Morue; Ger. Leberthran, Stockfischleberthran.

*Gadus*. L. a codfish, Gr. *γάδος*, same as *ὄνος*, L. *asellus*, a certain kind of fish.

*Mor'ru-a*. L. a cod (fish), fr. *morua*, *moruta*, ult. *merula*.

## TELEOST(EÆ)-IA.

**ANIMAL.**—The common codfish is .6–1 M. (2–3°) long, with brown or yellowish spots on the back; body is somewhat elongated and compressed, with soft small scales, none being on the head; fins soft, 3 on the back, 2 anal, and 1 distinct caudal; teeth irregular, pointed, in several ranks; gills large, 7-rayed.

**OLEUM MORRHUÆ, COD-LIVER OIL.**—Pale yellow thin oily liquid, peculiar, slightly fishy, not rancid odor, bland, fishy taste, sp. gr. 0.920; near 0° C. (32° F.) separates white granular deposit, soluble in ether, chloroform, carbon disulphide, slightly in alcohol. *Tests*: 1. Oil 1 drop dissolved in 20 drops chloroform, shaken with 1 drop sulphuric acid, acquires violet-red tint, changing to rose-red, brownish-yellow. 2. Sulphuric acid gives violet color; nitric acid gives red color at point of contact, by stirring mixture becomes bright rose-red, changing to lemon-yellow (dis. from seal oil, which at first shows no color change, and from other fish oils, which become at first blue, then brown and yellow). Should be kept cool, in well-stoppered bottles, having been well dried before filling. Dose, ʒj–4 (4–15 Cc.).

**ADULTERATIONS.**—Allied fish oils (seal, shark, menhaden, haddock, skate, etc.), other fixed oils, rosin (soluble in alcohol), paraffin oil (saponifies with potassium hydroxide in alcoholic solution), free fatty acids, lard oil.

**Commercial.**—Codfish are abundant on the coasts of Newfoundland, Norway, Nova Scotia, New England, north of Boston, and several species of *Gadus* are used for oil, as *G. callarias* (Dorsch = *Morrhua americana*), *G. carbonarius* (Coalfish), *G. pollachius* (Pollack), *G. merluccius* (Hake), and *G. æglefinus* (Haddock). Fishermen in small boats do most of the catching, Dec.–March; the fish after ashore are cleaned and salted, the livers being previously reserved for oil. This may be rendered in an atmosphere of carbon dioxide, thus preventing oxidation, or more frequently the livers are boiled simply with water or superheated steam to disintegrate tissue and allow the oil to separate. The entire pulstaceous mass is strained, and the liquid portion soon forms into a watery under layer and an oily upper layer; this latter, being drawn off and strained, is run into butts in the cooling room; when here frozen solid it is expressed through canvas bags, the hard, yellow residue (stearin and liver *débris*) is sold for soap-making, while the oil is barrelled or bottled for market, being known as *shore, white, pale yellow oil*. Frequently large boats remain from land weeks at a time, collecting and salting the fish, and throwing livers into barrels, where they decompose; the supernatant oil is racked off, bottled, the *débris* being thrown overboard or reserved; this oil is darker, less sweet than the shore oil, being known as *straits oil, brownish-yellow oil*. The remaining putrid *débris* may be heated with steam or water, giving a black oil, of offensive odor and taste, known as *banks oil, dark brown oil*. The oil-extracting is carried on by individuals in a small way on shore, or by large factories near seat of capture, and in remote places whither livers are sent in refrigerator cars. Good quality oil may be obtained by simply boiling livers in water to a pulp, straining through canvas, subsiding, decanting, filtering.

CONSTITUENTS.—Chiefly olein (physetolein) 70 p. c., palmitin 25 p. c., little stearin, palmitic acid 4 p. c., jecoleic acid,  $C_{19}H_{35}O_2$ , 20 p. c., therapeutic acid,  $C_{17}H_{29}O_2$ , iodine 0.001–0.002 p. c., 3 alkaloids—trimethylamine,  $C_3H_9N$ , aselline,  $C_{25}H_{32}N_4$ , morrhaine,  $C_{19}H_{27}N_3$  (diuretic, diaphoretic), cholesterol 0.5–1.5 p. c., traces of chlorine, bromine, phosphorus, sulphur 0.3 p. c., cholesterin, morrhic acid,  $C_9H_{13}NO_3$ , probably butyric and acetic acids. With alcohol (90 p. c.) oil yields 3.5–6 p. c. of extract called *morrhual*, in which active virtues reside.

PREPARATIONS.—1. *Emulsum Olei Morrhue*. Emulsion of Cod-liver Oil. (Syn., *Emulsio Olei Jecoris Aselli*; Fr. *Emulsion de Huile de Foie de Morue*; Ger. *Leberthranemulsion*.)

*Manufacture*: Rub acacia 12.5 Gm. with cod-liver oil 50 Cc. in dry mortar until mixed, add at once water 25, triturate lightly and rapidly until emulsion produced, add oil of gaultheria .4, syrup 10, water q. s. 100 Cc.; may replace oil of gaultheria by any other flavoring ingredient, as oil of bitter-almond, etc. Dose,  $\mathfrak{zj}$ –4 (4–15 Cc.).

2. *Emulsum Olei Morrhue cum Hypophosphitibus*. Emulsion of Cod-liver Oil with Hypophosphites. (Syn., *Emulsio Olei Jecoris Aselli cum Hypophosphitum*; Fr. *Emulsion de Huile de Foie de Morue avec les Hypophosphites de Chaux, de Soude et de Potasse*; Ger. *Leberthranemulsion mit unterphosphorigsauren Salzen*.)

*Manufacture*: Rub acacia 12.5 Gm. with cod-liver oil 50 Cc. in dry mortar until mixed, add at once water 25, triturate lightly and rapidly until emulsion produced, incorporate oil of gaultheria .4 Cc.; dissolve calcium hypophosphite 1 Gm., potassium hypophosphite .5, sodium hypophosphite .5 in water 10 Cc., mix with syrup 10, add this gradually to emulsion with trituration, add water q. s. 100 Cc.; may replace oil of gaultheria by any other flavoring ingredient, as oil of bitter-almond, etc. Dose,  $\mathfrak{zj}$ –4 (4–15 Cc.).

PROPERTIES.—Alterative, demulcent, emollient, nutrient. Owing to it already having been prepared by the liver, therefore partly elaborated, it is the most easily digested of the fats; increases red blood-corpuscles, body-weight, and healthy cell-formation throughout the tissues; pancreatic juice resolves it into glycerin and fatty acids, the latter unite with alkalies of the bile and intestinal juice, forming soaps, the larger portion, however, is emulsified by alkaline secretions of the intestines. It is absorbed readily by the skin, and large doses may occasion diarrhoea.

USES.—Wasting diseases, chronic phthisis, bronchitis, rheumatism, skin diseases, neuralgia, chorea, epilepsy, nerve tonic, convalescence from acute diseases, scrofula, white swelling, chronic arthritis (gout).

To take internally may disguise odor and taste. 1. Emulsion + oil of bitter-almond (1 to 250). 2. Porter  $\mathfrak{zj}$  (30 Cc.) + oil + plenty froth on top. 3. Orange- or lemon-peel chewed before and after taking. 4. Common salt, or a chew of salted or smoked herring before taking. 5. With soup or made into bread, jelly, etc. If oil nauseates, give before each dose potassium cyanide gr.  $\frac{1}{8}$  (.008 Gm.), or lime water  $\mathfrak{ziv}$  (15 Cc.), or bismuth subnitrate gr. 15–30 (1–2 Gm.).

## TELEOST(EÆ)-IA.

## Allied Oils:

1. *Oleum Squali, Shark Oil*.—From the liver of the shark—*Squa'hus Carcha'rias*; light yellow, limpid at  $-6^{\circ}$  C. ( $21.2^{\circ}$  F.).

2. *Oleum Rajæ, Ray Oil, Skate Oil*.—From livers of *Ra'ja Ba'tis*. France, Belgium; pale yellow, said to contain more iodine than cod-liver oil.

3. *Oleum Ceti, Sperm Oil*.—From *Physeter macrocephalus*; yellowish, in cold deposits spermaceti and stearin.

4. *Oleum Balæne, Whale Oil*.—From *Balæ'na mystice'tus* and *B. australis*; deposits at  $10^{\circ}$  C. ( $50^{\circ}$  F.).

## Allied Animals and Products:

1. *Ichthyocolla, Isinglass*.—The swimming-bladder of *Acipen'ser Hu'so*, and other species, official 1820–1900. Sturiones. Large fish, 4–4.5 M. ( $12-15^{\circ}$ ) long, weighing 1,000 pounds (455 Kg.) or more, and ranking with whales as regal or royal fishes. Swimming-bladder (isinglass) occurs in separate sheets or rolled, horny, pearly, whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; 1 part + 24 boiling water forms on cooling a transparent jelly. This swimming-bladder (“sound”) is a membranous bag (in front of the abdomen of most fishes) containing oxygen and nitrogen in various proportions, which enables the fish, by contracting or expanding, to lower or raise themselves in water; this bag consists of 3 coats: 2 interior (thin, delicate), 1 outer (tough, silvery-white); this latter is scraped off, discarded, and the inner bladder dried by (1) stretching into sheets, *leaf isinglass*, (2) folding several together, *book isinglass*, or (3) folding up around pegs, *long or short staple isinglass*; contains gelatin (glutin), insoluble membrane 2–30 p. c., ash 0.5 p. c.; solvents: boiling water, boiling diluted alcohol. Emplastrum Ichthyocollæ (Court Plaster)—Dissolve isinglass 10 Gm. in hot water q. s. 120 Gm.; with brush spread half of this in successive layers upon taffeta (stretched), add to other half alcohol 40 Gm., glycerin 1, apply as before, coat reverse side with tincture of benzoin. Nutritious, emollient, protective. Used in bowel derangements (children), mixed with farinaceous food, in clarifying liquors, to impart lustre to fabrics, as a test for tannin; plaster for cuts, abrasions, skin eruptions. Dose, *ad libitum*; Coxe's, Nelson's, as dietetic.

2. *American Isinglass*.—Sounds of *Ga'dus merlu'cius* (Hake) and *Otol'ithus rega'lis* (Weakfish), dried in thin sheets or ribbons.

3. *Purse or Pipe Isinglass*.—Dried fish-sounds without being cut open. Used sometimes in the arts as isinglass.

4. *Japanese or Chinese Isinglass* (Agar-agar).—A vegetable product from *Eucheu'ma spino'sum*, *Sphaerococ'cus lichenoi'des*, and other Algae.

5. *Chondrin*.—This resembles gelatin, being from cartilages of the ribs and other non-ossifying cartilages; its aqueous solution is precipitated by alum, lead acetate, ferric salts, acetic and mineral acids, but not by tannin or mercuric chloride; used as emollient, nutritive, protective, as the basis for suppositories, pessaries, bougies, capsules, lozenges, pill-coating, etc. Differs from gelatin in containing less

nitrogen, more oxygen, in precipitating with acetic and mineral acids, but not with tannin.

6. *Vitellus, Yolk of Egg*.—The yolk of the egg of *Gal'vus Ban'-kiva* var. *domesticus*, official 1880–1900. Gallinæ. Java, Cochin-China; domesticated. Animal, known as the domesticated or dung-hill fowl, originated from the red jungle-fowl, to which our nearest approach is the game-cock. The eggs give 3 pharmaceutical products—*shell* 10 p. c., *albumin* 60 p. c., *yolk* 30 p. c. Yolk of egg (vitellus) is a viscid, yellow, opaque, alkaline liquid—being an emulsion of oil suspended in water by albumin; coagulates by heat and upon the addition of alcohol; gives whitish emulsion with water; yields to ether yellow fat and separates a white mass; odorless, bland taste; contains water 48–55 p. c., vitellin 16 p. c. (a proteid related to casein, mixed with albumin), fat 30 p. c., inorganic salts 1.5 p. c. (chlorides, sulphates, and phosphates of potassium, sodium, calcium, magnesium), cholesterin 0.42 p. c., lecithin, coloring matter, lactic acid, sugar. Glyceritum Vitelli—Rub fresh yolk of egg 45 Gm. in a mortar, with glycerin 55 Gm. gradually added, until thoroughly mixed. Nutritious, laxative; jaundice, dyspepsia; chiefly in pharmacy for emulsifying oils, dressing for burns, scalds, abrasions, to soften cutaneous crusts, cerumen in the ear. Dose, 1–2 yolks.

7. *Albumin Ori, White of Egg*.—Weighs 3v–6½ (20–25 Gm.); contains water 82–88 p. c., solids 12–18 p. c., mostly albumin, little fat, sugar, extractive, ash 0.65 p. c., of which 42 p. c. is KCl and 9 p. c. NaCl, the remainder being carbonates, phosphates, sulphates of alkalies, calcium, magnesium, and iron. It is nutritious, clarifies honey, syrup, and other liquids, is an antidote to metallic poisons (mercuric chloride, copper salts, etc.).

8. *Testa Ovi, Egg-shell*.—Composed of calcium carbonate 90–97 p. c., calcium and magnesium phosphates 1–5.7 p. c.; organic matter 2–4.7 p. c. It is antacid; once popular remedy for gravel.

CLASS 3: **MAMMALIA**. L. fr. *mammalis*, of the breast. The highest class of vertebrata. Distinguished by all being warm-blooded, viviparous, suckling their young by a mammary gland, nipples, breathing by lungs.

### 5. CETACEA. Cetaceous Family.

Se-ta'se-a. L. *cetus*, Gr. *κῆτος*, a whale—i. e., pertaining or belonging to the whale. All animals of this family have pelvis and hind limbs somewhat atrophied, a fish-like body, specialized for aquatic progression, ending in a horizontal tail or flukes; short fore-limbs like fins or flippers, 1 at least of the digits with more than 3 phalanges; neck usually short; some of the cervical vertebræ ankylosed together.

Genus: 1. **Physeter**.

## CETACEA.

## CETACEUM. SPERMACETI.

**Physeter macrocephalus**, Linné. } A peculiar, concrete, fatty substance from the head of the sperm whale.

*Habitat.* The Pacific and Indian Oceans.

*Syn.* The Sperm Whale; Fr. Blanc de Baleine, Cétine, Spermacéti, Ambre blanc: Ger. Cetaceum, Walrat, Spermaceti, Wallrath

**Phy-se'ter.** L. fr. Gr. *φυσήρη*, a blow-pipe, a kind of whale; *φυσά*, a pair of bellows, wind; *φυσάν*, blow—i. e., the sperm whale has a blow-hole near the edge of the snout.

**Mac-ro-ceph'a-lus.** L. fr. Gr. *μακρός*, long, + *κεφαλή*, head—i. e., animal has a long or large head.

**ANIMAL.**—Usually 18–24 M. (60–80°) long, enormous head, being often 9 M. (30°) in circumference, and composing one-third its whole length. In front of the cranium the upper jaw has a large cavity containing an oily liquid, which, being removed in buckets shortly after death, congeals into a yellow mass. It is drained in suitable bags, pressed to remove oil, pressed-cake purified by melting in water, impurities skimmed off, boiled with weak potassium hydroxide solution, washed with water, and allowed to congeal.

**CETACEUM, SPERMACETI.**—This (as thus congealed) is in white, somewhat translucent, slightly unctuous masses of scaly-crystalline fracture, pearly lustre, faint odor, bland, mild taste, yellowish and rancid on exposure, sp. gr. 0.940, melts at 50° C. (122° F.), soluble in ether, chloroform, carbon disulphide, fixed and volatile oils, insoluble in water, nearly so in cold alcohol. *Test.*: 1. Boil 1 Gm. with 1 Gm. anhydrous sodium carbonate + 50 Cc. alcohol, cool, filter, supersaturate filtrate with acetic acid, may get turbidity but no precipitate (abs. of stearic acid).

**CONSTITUENTS.**—Mainly cetylic alcohol or ethal,  $C_{16}H_{33}OH$ , combined with palmitic acid,  $HC_{16}H_{31}O_2$ , forming a fat, cetin (cetyl palmitate),  $C_{16}H_{33}.C_{16}H_{31}O_2$ , also small amounts of fat containing stearic, myristic, and lauro-stearic acids.

**PREPARATIONS.**—1. *Unguentum Aquæ Rosæ*, 12.5 p. c.

*Unoff. Prep.*: *Ceratum*, 10 p. c., + white wax 35, olive oil 55.

**PROPERTIES AND USES.**—Lenitive, demulcent, emollient, as a basis for ointments, eerates, etc., alvine and urinary derangements. May be given in emulsion with egg-yolk or almond oil, or powder made by rubbing down with alcohol or little almond oil.

*Derivative Product*:

1. *Ambra Grisea, Ambergris.*—This is a morbid excretion found in the intestines of the sperm whale, also floating on the sea. A single whale has produced 750 pounds (340 Kg.). It is in irregular masses, brownish-gray color, with lighter and darker streaks and spots, fusible in hot water, friable in the cold, sp. gr. 0.800–0.920. Soluble in ether, fats, volatile oils, hot alcohol, insoluble in potassium hydroxide solution; odor peculiar, fragrant, nearly tasteless; contains ambrein (fatty substance resembling cholesterin) 85 p. c., balsamic extractive, sodium



chloride, benzoic acid (?), coloring matter, little ash. Used as stimulant, antispasmodic, mostly in perfumery, for fixing odor. Dose, gr. 5–15 (.3–1 Gm.).

## 6. PACHYDERMATA. *Pachyderma*(l)-tous Family.

**Pak-i-der'ma-ta.** L. fr. Gr. *παχύς*, thick, + *δέρμα*(τ), skin. All animals of this family have thick skin, are non-ruminant ungulate mammals, or hoofed quadrupeds which do not chew the cud, such as elephants, hippopotamuses, swine, rhinoceroses, hyraxes, tapirs, horses, etc.

Genus: 1. *Sus*.

### SUS SCROFA. THE HOG.

1. **ADEPS.** Lard.

2. **PANCREATINUM.** Pancreatin.

3. **PEPSINUM.** Pepsin.

*Sus scrofa* var.  
*domesticus*, Gray.

- |   |  |
|---|--|
| { | <ol style="list-style-type: none"> <li>1. The prepared internal fat of the abdomen of the hog, purified by washing, melting, straining.</li> <li>2. A mixture of enzymes (unorganized ferments) naturally existing in the pancreas of warm-blooded animals, usually obtained from fresh hog or ox pancreas.</li> <li>3. A proteolytic ferment or enzyme from the glandular layer of the fresh stomach of the hog (sheep, calf).</li> </ol> |
|---|--|

*Habitat.* Domesticated from the wild boar and closely related forms; universal.

*Syn.* 1. Br. *Adeps Præparatus*, *Axungia*, *Axungia Porci* or *Porcina*. Prepared (Hog's) Lard; Fr. *Axonge*, *Graisse de Porc*, *Saindoux*; Ger. *Adeps suillus*, *Schweineschmalz*. 2. Fr. *Pancreatina*, *Pancréatine médicinale*; Ger. *Pancreatin*. 3. Fr. *Pepsina*, *Pepsine*; Ger. *Pepsin*.

*Sus.* L. fr. Gr. *ὑς*, a hog, pig—i. e., the Linnean name of the genus.

*Scrof'a.* L. a breeding sow—i. e., its classic name.

*Do-mes'ti-cus.*—L. domesticated, belonging to the household, fr. *domus*, house.

**ANIMAL.**—About .6–1.3 M. (2–4°) long, .3–1 M. (1–3°) high, weighing from 15–800 pounds (7–365 Kg.), sometimes with side tusks (long canines); color iron-gray, white, or black, with long, drooping ears and more or less elongated snout. It is very important to man for its meat, fat, and entrails.

**I. LARD:** This fat is from the mesentery, omentum, and kidneys of winter-killed hogs; it is deprived of blood, external membranes, cut into small pieces, and heated on water-bath until melted, then strained through flannel. To make inodorous, may add to each pound (.5 Kg.) of melted lard, alum 15 gr. (1 Gm.) and sodium chloride 30 gr. (2 Gm.), boil until scum rises, remove this, strain, cool, work

**PACHYDERMATA.**

on slab with a stream of water to remove salts, remelt, and heat until all water is dissipated. It should be kept cool in well-closed vessels impervious to fat. It is a soft, white, unctuous solid, faint odor; non-rancid, bland taste; soluble in ether, chloroform, carbon disulphide, petroleum benzin, insoluble in water, slightly in alcohol; sp. gr. 0.917; melts at 38–40° C. (100.4–104° F.), again congealing at 30° C. (86° F.). *Impurities*: Alkalies ( $\text{Na}_2\text{CO}_3$ ), chlorides ( $\text{NaCl}$ ), free fatty acids, cottonseed oil (fats), other fats.

**CONSTITUENTS.**—Olein (Oleum Adipis) 50–60 p. c., palmitin, stearin.

**Oleum Adipis. Lard Oil, official.**—(Syn., Fr. Huile de Graisse; Ger. Schmalzöl, Specköl.) This fixed oil is expressed from lard by enclosing it in strong canvas bags, exposing to 0° C. (32° F.) for a time, then subjecting to a gradually increased pressure, by which the stearin is separated from the olein. It is a colorless or pale yellow oily liquid, peculiar, fatty odor, bland taste, sp. gr. 0.915, begins to congeal at 10° C. (50° F.), and is a semi-solid white mass at 0° C. (32° F.), soluble in ether, chloroform, benzene, carbon disulphide, nearly insoluble in alcohol; contains olein, palmitin, stearin. *Tests*: 1. Oil 5 Cc. shaken with 5 Cc. alcoholic solution silver nitrate (0.1 Gm. + 10 Cc. alcohol, + 2 drops nitric acid), heated, should remain colorless, not reddish or brown (abs. of more than 5 p. c. of cottonseed oil). 2. Oil should be saponifiable with alcoholic potassium hydroxide T. S., and resulting soap should be soluble in water, without separation of an oily layer (abs. of mineral or paraffin oils). *Impurities*: Cottonseed oil, mineral oils, other fats. Seldom used in medicine, but as an illuminant and in preparations.

**PREPARATIONS.**—1. *Adeps Benzoinatus.* Benzoinated Lard—lard 100 Gm. + benzoin 2 Gm. See page 476.

*Preps.*: 1. *Ceratum.* Cerate. (Syn., Ceratum Simplex (Adipis); Fr. Cérat simple; Ger. Unguentum cereum, Wachssalbe, Einfaches-cerat.)

*Manufacture*: Heat until liquefied white wax 30 Gm., add white petrolatum 20, then benzoinated lard 50, stir mixture constantly until it congeals. When for hot-weather use, may replace 10 p. c. of benzoinated lard by white wax.

2. *Unguentum.* Ointment. (Syn., Unguentum Simplex (Adipis); Fr. Pommade simple; Ger. Wachssalbe.)

*Manufacture*: Melt white wax 20 Gm., add benzoinated lard 80, heat until liquefied, stir until it congeals.

*Preps.*: 1. *Unguentum Acidi Tannici*, 60 p. c. 2. *Unguentum Gallæ*, 80 p. c.

3. *Ceratum Camphoræ*, 40 p. c. 4. *Unguentum Belladonnæ*, 65 p. c. 5. *Unguentum Chrysarobini*, 95 p. c. 6. *Unguentum Hydrargyri*, 25 p. c. 7. *Unguentum Iodi*, 80 p. c. 8. *Unguentum Potassii Iodidi*, 80 p. c. 9. *Unguentum Stramonii*, 65 p. c. 10. *Unguentum Sulphuris*, 85 p. c. 11. *Unguentum Veratrinæ*, 90 p. c. 12. *Unguentum Zinci Oxidi*, 80 p. c.

2. *Ceratum Cantharidis*, 17 p. c. 3. *Ceratum Resinae*, 50 p. c. 4. *Unguentum Hydrargyri Nitratis*, 76 p. c. 5. *Unguentum Iodoformi*, 90 p. c. 6. *Unguentum Picis Liquidæ*, 35 p. c.

PROPERTIES AND USES.—Lard is emollient. Employed mostly externally as a basis for ointments, cerates, and to preserve softness of poultices. The benzo(in)ated lard does not become rancid quickly by exposure, consequently this property and its odor particularly commend it.

II. PANCREATIN (Zymine): This may be extracted similarly to pepsin by macerating the finely minced fresh pancreas (sweet-breads) in acidulated (HCl) water, and separating with sodium chloride, or may be mixed with cold water, kneaded for an hour, filtered through flannel, and equal volume of alcohol added; the precipitate is drained, dried on trays at 40° C. (104° F.), then powdered. If instead of the water we use water saturated with chloroform, decomposition will greatly be retarded; may also rub up the product with sugar of milk without heat, which will keep it dry and prevent decomposition. It is a cream-colored, amorphous powder, faint, peculiar, not unpleasant, odor, somewhat meat-like taste, slowly soluble in water (10 p. c. insoluble), insoluble in alcohol; acts in neutral, faintly acid, but best in faintly alkaline media; alkali carbonates are slightly inhibitory, while contact with pepsin in solution is injurious. It consists principally of amylopsin, myopsin, trypsin, steapsin, rennin, and is capable of converting at least 25 times its weight of starch into substances soluble in water; it converts albuminoids to peptones (myopsin, trypsin), starch to sugar (amylopsin), emulsifies fats (steapsin), coagulates milk (rennin, renfer). *Test*: 1. 5 gr. (.3 Gm.) should emulsify cod-liver oil 3j (4 Cc.). *Assay*: Boil in flask 7.5 Gm. starch + 120 Cc. distilled water until translucent mixture results, cool to 40.5° C. (105° F.), add pancreatin 0.3 Gm. dissolved in 10 Cc. warm distilled water, shake, keep warm 5 minutes, yielding converted starch and thin liquid; mix 2 drops  $\frac{N}{10}$  iodine V. S. with 60 Cc. distilled water, add 2 drops warm converted starch solution, should get no color, or at most wine-red, showing presence of dextrin and maltose—blue or purple would indicate unconverted starch, that pancreatin is below standard, not able to convert 25 times its weight. Dose, gr. 5–15 (.3–1 Gm.).

PROPERTIES AND USES.—It was used first in medicine for its emulsifying properties, hence of service as a ferment in dyspepsia and in the pre-digestion of food. Useful to assist the digestion of infants, invalids, old persons, and those prostrated by fever or exhaustion. Thus to peptonize or pre-digest, take pancreatin gr. 5 (.3 Gm.), sodium bicarbonate gr. 20 (1.3 Gm.), warm water 3j (30 Cc.); when dissolved put into warm milk Oj (.5 L.), and keep temperature at 43° C. (110° F.) for an hour.

III. PEPSIN: This may be made by several processes (yielding two kinds—*precipitated* and *scale* or *soluble*), each producing pepsin of different digestive strength. The original method consisted in chopping up finely the inside mucous membrane of the pig's stomach and mac-

**PACHYDERMATA.**

erating it in acidulated (HCl) water for several days, the liquid portion is strained off, and to it sodium chloride is added; this precipitates the pepsin, which, rising to the surface, is skimmed off, pressed, and dried. A more modern method employs sodium sulphate (instead of sodium chloride), which, together with peptone, is removed by dialysis, then residual solution concentrated and dried on glass plates. It is a fine white or yellowish amorphous powder, or in yellowish, transparent or translucent grains or scales, free from offensive odor, mildly acidulous or saline taste, bitter, hygroscopic; soluble in 50 parts water, with opalescence, more soluble in acidulated (HCl) water, insoluble in alcohol, chloroform, ether, acid or neutral reaction, never alkaline; proteolytic power destroyed by alkalis, alkaline earths, alkali carbonates, stronger hydrochloric acid than 0.5 p. c., alcohol, heat (71° C.—160° F.); precipitated by tannic or gallic acid, many heavy metals; incompatible with pancreatin, this in neutral or alkaline solution destroying pepsin, while in acid media being destroyed by the pepsin; it converts nitrogenous food (proteids—albumin, casein, fibrin, muscle) into albumoses and finally to soluble peptones; acts only in acid media, but when acid solutions are heated to 100° C. (212° F.) they lose all proteolytic power, becoming milky or with precipitate. *Tests*: 1. Should be capable of digesting not less than 3,000 times its weight of freshly coagulated and disintegrated egg-albumin. 2. Exposed to dampness should not become sticky (abs. excess of peptone); should dissolve clear in water, not turbid with acetic acid (abs. of mucus); that by Scheffer's process turbid, owing to presence of syntonin or acid albumin. 3. Should be free from disagreeable odor, not blue (starch) or purplish-red (dextrin) with iodine T. S. *Assay*: Mix 9 Cc. diluted hydrochloric acid with 291 Cc. distilled water, in 150 Cc. of this dissolve 0.1 Gm. pepsin; boil a hen's egg 15 minutes, rub through a 40 sieve, rejecting first portion; to 10 Gm. of succeeding portion add 20 Cc. acid liquid, disintegrate albumin with glass rod tipped with cork, rinse rod with 15 Cc. acid liquid, add 5 Cc. solution pepsin, cork, invert three times, heat 2½ hours to 52° C. (126° F.), inverting every 10 minutes, add 50 Cc. cold distilled water, let stand, the deposit of undissolved albumin should not be more than 1 Cc. When pepsin of a higher digestive power is to be reduced, sugar of milk should be employed for the purpose. Dose, gr. 5–30 (.3–2 Gm.).

**PREPARATIONS.**—(Unoff.) *Pepsinum Saccharatum* (official 1880–1900), 10 p. c., dose gr. 5–60 (.3–4 Gm.). *Essence*, 4 p. c. *Liquid*, 4 p. c. *Glycerite*, 8.5 p. c. *Wine*. *Aromatic Liquid*. *Liquor Pancreatis* (Br.). Dose, each, 3j–4 (4–15 Cc.).

**PROPERTIES AND USES.**—As a ferment to assist gastric digestion in persons having deficient secretion of gastric juice, in old persons during convalescence from long illness, cancer of stomach, diarrhœa, diabetes; does not aid digestion of fats or carbohydrates. Should be given after meals, and followed half hour afterward by dose of hydrochloric acid.

*Allied Products*:

1. *Diastase*.—Amyolytic ferment from infusion of malt (barley,

oats, wheat, potato), by adding a little alcohol to overcome viscosity, coagulate albumin, etc., filtering and adding alcohol sufficient to precipitate the diastase; yield 0.2–1 p. c. It is a white powder, tasteless, soluble in water, insoluble in alcohol; 1 part should convert 2,000 of starch into dextrin and maltose. *Taka-Diastase* is a kindred ferment resulting from the action of a fungus (*Aspergillus*) upon sterilized bran or steamed rice. It is a yellowish-white powder, hygroscopic, nearly tasteless, soluble in water; claimed to convert 100 times its weight of starch into glucose within 10 minutes. Dose, gr. 2–5 (.13–.3 Gm.), immediately after meals.

2. *Papayotin, Papain, Caricin*.—Albuminous ferment from the fruit of the melon tree or Pawpaw (*Carica Papa'ya*). Tropical America. Tree 6 M. (20°) high, stem 30 Cm. (12') thick, fruit approximates the size of one's head, and contains an acrid, astringent, bitter, milky juice, which soon separates into a coagulum and aqueous liquid, from which latter papayotin is precipitated upon the addition of alcohol. It is a whitish, hygroscopic powder, inodorous, tasteless, soluble in water, glycerin, active in neutral, acid, but more so in alkaline solutions; it converts starch into maltose, albuminoids into peptones, and emulsifies fats; should digest 200 times its weight. Papoid, Caroid, etc., are weaker forms (dried juice); slightly inferior to pepsin, greatly inferior to pancreatin. Dose, gr. 2–5 (.13–.3 Gm.).

3. *Ingluvin*.—This is claimed to be a bitter principle contained in the fowl's gizzard. Dose, gr. 5–15 (.3–1 Gm.).

## 7. RUMINANTIA. Ruminant Family.

Ru-mi-nan'shi-a. L. fr. *ruminan(t)s*, ruminating, chewing the cud. All animals of this family (bos, camel, deer, neat cattle, sheep, etc.) are hoofed quadrupeds, cloven-footed, even-toed, with 4 stomachs, or 1 with 4 divisions. Food being slightly masticated goes to No. 1 stomach, where it is ground finer; now passes to No. 2, where it is formed into balls, which are returned to the mouth and chewed again, constituting the cud; thence the food passes to Nos. 3 and 4 stomachs, where it is digested and assimilated.

Genus: 1. *Moschus*. 2. *Ovis*. 3. *Bos*.

## MOSCHUS. MUSK.

*Moschus moschiferus*, Linné. } The dried secretion from the preputial follicles.

*Habitat*. Central Asia, from India to Siberia.

*Syn*. *Moschus Orientalis*—*Chinensis*—*Tibetanus*; Fr. *Musc*; Ger. *Moschus*, *Bisam*.

*Mos'chus*. L. musk. Gr. *μόςχος*, fr. Skt. *mushka*, testicle, orig. a little mouse.

*Mos-chif'e-rus*. L. *moschus*, musk, + *ferre*, to bear—i. e., musk-producing.

ANIMAL.—The musk deer resembles closely our own deer in shape, size, etc.; it, however, has no horns, but a tusk on each side. It is 1

## RUMINANTIA.

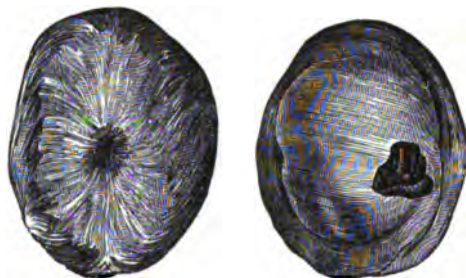
M. (3°) long, .6 M. (2°) high, with haunches higher than shoulders; from upper jaw on either side the canines project downward 2 inches out of the mouth, forming tusks curved backward, which serve in extracting roots, etc., for food; ears long, narrow, hair undulated, strong, elastic, iron-gray color, whitish toward root, blackish near apex. SECRETION (musk), occurs in irregular, crumbly, unctuous grains, dark reddish-brown, odor peculiar, penetrating, persistent; taste bitterish; it is contained in roundish sacs (pods, pouches) 5–7.5 Cm. (2–3') long, 2.5–5 Cm. (1–2') broad, one side (upper) flat with smooth membrane, the other (under) convex and covered with stiff, appressed, grayish hairs, concentrically arranged around 2 orifices near the centre. About 10–12 p. c. soluble in alcohol, forming a brownish-yellow tincture becoming turbid on adding water; 50–75 p. c. soluble in water, form-

FIG. 433.



Musk deer.

FIG. 434.



Chinese musk sac: a, lower surface; b, upper surface.

ing deep brown solution, faintly acid, strongly odorous, moisture 15 p. c., when burnt get urine odor, grayish ash 8 p. c. *Solvents*: diluted alcohol; ether; hot water partially. Dose, gr. 1–10 (.06–.6 Gm.).

**ADULTERATIONS.**—1. Artificial musk bags made of hairy skin and filled with foreign substances. These possess none of the characteristics belonging to the true bag as previously described. Often the natural sacs are opened, the secretion in part or whole abstracted, and the sac refilled with dried blood, resin, lead, sand, iron filings, hair, bird dung, wax, storax, benzoin, asphaltum, artificial musk, etc. In these sacs the sewed-up seam should at once excite suspicion, and lead to testing the contents.

**Commercial.**—Musk is derived alone from male animals, being secreted in a projecting hairy sac situated between the umbilicus and prepuce; anteriorly the sac has a small hairy orifice, and posteriorly a furrow corresponding with the opening of the prepuce; internally it is lined by a smooth membrane, much convoluted to form incomplete partitions, which secretes the musk. A well-developed adult animal yields 2–6 drachms (8–24 Gm.) of this secretion, which is a brown, thickish liquid, but milky in the young deer. This musk deer inhabits the pine forests of the Himalayas, 900–4,200 M. (3,000–14,000°) elevation, from India to Siberia to Thibet, seeking the inaccessible snowy recesses and cliffs. It is timid, active, fleet-footed, hiding by

day, searching for food at night; it is hunted for the hides, secretion, etc., and although abundant very few are taken, owing to their habits and apparent intelligence, and then only by snares, pitfalls, or shooting. When dead the sac is cut off at once, dried by pressing against heated stones, and sent into market. There are several varieties:

1. *Chinese, Thibet, Tonquin*.—This is the best, and while it is claimed to come from Tonquin, much is obtained from Yun-Nan in S. China, and shipped via Shanghai. Some enters commerce via Calcutta, in lead-lined boxes holding 25 sacs, each sac wrapped carefully in paper; these sacs are nearer round than the others.

2. *Siberian, Russian*.—This comes via St. Petersburg, and is sometimes scarcely inferior to Chinese, but generally weaker, with more fetid odor and ammoniacal smell. When this is in flat, oval sacs, which is its usual form, and has thin, light hairs, it is called *Cabardine musk*.

3. *Bucharian and Assam*.—This is in small sacs, often with portions of hide adhering; seldom reaches our market.

4. *Artificial Musk*.—This is the trinitro-isobutyl-methyl-benzol, and is obtained by acting on tertiary butyltoluene with nitric and sulphuric acids, then heating for 8 hours, or by treating rectified oil of amber with fuming nitric acid. It is a brown, resinous mass, capable of being powdered, of a musk-like odor, which is quickly lost on exposure, and often sold under the name of *Tonquinol, Bauer, Canton musk*. The homologues of isobutylxylol have an analogous odor.

CONSTITUENTS.—Ammonia, an acid, cholesterin, fat, wax, gelatinous and albuminous principles, ash 8 p. c. = mostly  $\text{NH}_4$ , Ca, K—chlorides. The odorous principle is not a volatile oil, although it has not been isolated it volatilizes partly with steam, and is formed probably by slow continuous decomposition of one of the constituents in the presence of moisture; this is so powerful that a few grains, well protected, will impregnate a room for years without material loss of weight. Also 1 part will saturate strongly 3,000 parts of an inodorous powder. This odor, however, may be removed by triturating with camphor, hydrocyanic acid, ergot, fennel or oily seeds, or by prolonged drying over sulphuric acid, but odor returns upon absorbing moisture. The German Pharmacopœia requires musk dried by this last process. Alkalies render musk more soluble and the odor more pronounced.

PREPARATIONS.—1. *Tinctura Moschi*. Tincture of Musk. (Syn., Fr. Teinture de Muse; Ger. Moschustinktur.)

*Manufacture*: 5 p. c. Triturate 5 Gm. with water 45 Cc., little at a time, to smooth mixture, let stand 1 day in bottle, add alcohol 45 Cc., macerate 6 days, occasionally agitating, filter, add diluted alcohol q. s. 100 Cc. Dose, ʒss–2 (2–8 Cc.).

*Unoff. Preps.*: Pill (*Pilula*). Enema. Emulsion. Suppositories.

PROPERTIES.—Antispasmodic, nervine, anodyne, diffusible stimulant, aphrodisiac—similar to valerian, asafetida, camphor, ammonia. Acts directly on the heart and nervous system, producing alcoholic symptoms, stimulates respiratory centre; may cause headache, nausea.

USES.—Typhoid fever, typhus and eruptive fevers, pneumonia, in-

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fantile convulsions, hiccough, pharyngeal spasms, spasmodic croup or cough, whooping-cough, vomiting, colic, hysterical convulsions, tetanus, delirium tremens, rheumatism, cholera infantum, false croup; externally in plaster for muscular rheumatism, sprains, etc.

*Allied Animals:*

1. *Cas'tor Fi'ber*, *Castoreum*, *Castor*, *Beaver*.—Rodentia. The dried preputial follicles, and their secretion, obtained from the male and female animal, separated from the frequently attached shorter and smaller oil sacs, official 1820–1880. Canada, Russia. Beaver is about .6–.8 M. ( $2-2\frac{1}{2}$ °) long; tail 25–30 Cm. (10–12') long, 7.5–10 Cm. (3–4') wide, flattened, hairy at base, scaly at end; head like a rat's; has no canines, but 2 incisors, 4 molars all around for gnawing; hair brownish. The American or Canadian is smaller, with darker fur, follicles weigh 1–4 ounces (.03–.12 Kg.), and are used mostly. Russian or Siberian has follicles pyriform, 2–8 ounces (.06–.24 Kg.); odor more agreeable, 7.5 Cm. (3') long, club-shaped, in pairs, wrinkled, brown; contents brown,

FIG. 435.

*Castor Fiber*: b, scales of the tail.

FIG. 436.

*Castor follicles*: one-fourth natural size.

hard, friable. Alcohol dissolves one-half, giving brown tincture, turbid on adding water, clarified by ammonia; contains volatile oil, having phenol (carbolic acid) 1–2 p. c., resinous substance (bitter) 14–58 p. c., castorin, salicin, osmazone, urates, benzoates, cholesterin, ash 3.5 p. c. Used as stimulant, antispasmodic, emmenagogue, for hysteria, fevers, epilepsy, typhoid, amenorrhœa; in decoction, tincture. Dose, gr. 10–30 (.6–2 Gm.). It is weaker than musk, and presents no advantage over valerian, camphor, ammonia, ether, etc. It is adulterated with blood, resins, minerals, calcium carbonate, goat scrotums, etc., sometimes to 50 p. c. The oil-sacs furnish our once official *Azungia Castoris*.

2. *Cer'vus El'aphus*, *Cornu Cervi*, *Stag's Horn*, *Hart's Horn*.—The horn of the stag, a species of deer, official 1820–1840. The hard, bony horns yield by boiling with water a transparent, colorless, inodorous jelly, and then incineration (of cleaned bones) gives pure calcium phosphate, which was mixed with antimony sulphuret and subjected to white heat, yielding antimony oxide and calcium phosphate; as such was a compound of our first-made antimonial or James' powder, U. S. P.

3. *Antil'ope Dor'cas*.—N. Africa. Deer-like, ruminant animal, whose globular excrements have strong musk-odor, for which it is



used in perfumery. *Hy'rax capen'sis*, *Hyraceum*, S. Africa. The dry excrements of the badger or klipdas, a mammal .5 M. (18') long, black. When hot has castor oil odor; partly soluble in water, less so in alcohol, ether.

4. *Civet'ta* and *Zib'ethum*, *Civet*.—Animal .6–1 M. (2–3°) long, .3 M. (1°) high, unctuous secretion in the pouch between anus and genitals of both sexes of *Viver'ra Civet'ta* and *V. Zib'etha*. Africa, S. Asia. These are grown for secretions, which are removed by ladles; it is at first yellow, then dark brown. Like musk medicinally, but mostly used in perfumery.

### OVIS ARIES. THE SHEEP.

1. SEVUM PREPARATUM. Prepared Suet.

2. ADEPS LANÆ. Wool-fat.

*Ovis aries*, Linné. { 1. The internal fat of the abdomen of the sheep, purified by melting and straining.  
2. The purified fat of the wool of sheep, freed from water.

*Habitat*. Domesticated, and form a variety from either the Siberian (*Ovis Ammon*) or S. Europe sheep (*Ovis Musimon*).

*Syn*. 1. Sevum, U. S. P. 1890; Fr. Suif de Mouton, Graisse de Mouton; Ger. Sebum ovile (ovillum), Hammeltalg, Talg. 2. Lanolinum, Lanolin (L. *lana*, wool, + *oleum*, oil, + *in*), Agnin, Oesipus, Oesipum, Woolfat; Fr. Suint de Laine; Ger. Wollfett, Adeps Lanæ Anhydricus, Wollfett.

*O'vis*. L. sheep, fr. Gr. *ovis*, a sheep, from which comes our ewe—i. e., original name.

*A'ri-es*. L. a ram. fr. OE. *ares*—i. e., the original name for the male species.

**ANIMAL**.—This is one of the most useful animals to man. The male is a ram, the female an ewe, and the young a lamb; the flesh of the latter is called lamb, that of the adult mutton; the fleece is wool, the principal component of our warm clothing; the prepared hide is the useful sheepskin; the entrails furnish sausage skins, and when dried (catgut) are twisted into musical instrument strings. In addition to all these we have the two official products as above named. There are many varieties of sheep, but the most important are: 1. Leicester. 2. Cotswold. 3. Southdown. 4. Cheviot. 5. Astrakhan. 6. Cre-tan. 7. Merino.

**I. PREPARED SUET**: This is taken chiefly from around the kidneys, and is prepared by freeing from adhering membrane and blood, cutting into pieces, melting carefully, and straining through cotton or flannel; may also boil it in water, when it rises to the surface, leaving the water and impurities as a substrata. It is a white solid fat, slight odor, bland taste, becoming rancid by age; melts at 46° C. (115° F.), congeals at 39° C. (102° F.); soluble in 60 parts ether, 44 boiling alcohol, 2 parts petroleum benzin, insoluble in water, cold alcohol. Should be kept in well-closed vessels impervious to fat, and not used when rancid.

**CONSTITUENTS**.—Stearin and palmitin 70 p. c., olein 30 p. c., hircin a trace.

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PREPARATIONS.—1. *Ceratum Resinæ Compositum*, 30 p. c. 2. *Unguentum Hydrargyri*, 23 p. c.

PROPERTIES AND USES.—Lenitive, when rancid an irritant. Chiefly in cerates, ointments, plasters, as it is thicker than lard, for dressing blisters, excoriated surfaces, chapped hands, etc.

*Allied Fat:*

1. *Sevum Bovinum*, *Beef Tallow*.—This is the internal fat of *Bos taurus*; it is similar to the preceding, except that it has a slightly different odor; melts at 40° C. (104° F.), and contains more palmitin, and no hircin.

II. WOOL-FAT: This is prepared from sheeps' wool, usually containing about 45 p. c. of its weight in fat, which must be removed before the wool can be utilized in making fabrics, and is accomplished by treating the wool with a weak solution of sodium hydroxide to produce an emulsion or soap; this creamy mixture may be dissolved in ether, alcohol, or benzin, or put into a centrifugal machine, which separates it into an upper layer of cholesterin and fats, and a lower layer—soap solution of the impure fatty acids; the upper layer is treated with calcium chloride, after which the fat is separated and dehydrated, fusing in the presence of unslaked lime; from this mixture acetone is used to extract the pure wool-fat, which remains upon distilling off the solvent. It is a light yellowish, tenacious, unctuous mass, slight peculiar odor, soluble in ether, chloroform, insoluble in, but miscible with large quantities of, water, melts at 40° C. (104° F.). *Test*: 1. Solution in chloroform (1 in 50), poured upon sulphuric acid, develops brownish-red color at line of contact. *Impurities*: Alkalies (free), chlorides, free fatty acids, organic nitrogenous matter.

CONSTITUENTS.—Cholesterin,  $C_{27}H_{49}OH$ , ischolesterin, cerylic, carnaubic, lanolinic, and other alcohols, esters of lanopalmitic, myristic, carnaubic, oleic, and other acids, ash 0.3 p. c.

PREPARATIONS.—1. *Adeps Lance Hydrosus*. Hydrous Wool-fat. (Syn., *Adeps Lanæcum Aqua*; Ger. *Adeps Lanæ cum Aqua*, *Wasserhaltiges Wollfett*.)

*Manufacture*: Place wool-fat in a warm mortar, add with constant stirring not more than 30 p. c. of water. It is a yellowish-white, ointment-like mass, slight peculiar odor, insoluble in water, but miscible with twice its weight without losing its ointment-like character, turbid with ether or chloroform, melts at 40° C. (104° F.), separating into an upper oily and a lower aqueous layer. *Test*: 1. When heated on water-bath with stirring there should be a residue of 70 p. c., which should respond to *Adeps Lanæ*.

Preps.: 1. *Emplastrum Hydrargyri*, 10 p. c. 2. *Unguentum Belladonnæ*, 20 p. c. 3. *Unguentum Hydrargyri Ammoniaci*, 40 p. c. 4. *Unguentum Hydrargyri Oxidi Flava*, 40 p. c. 5. *Unguentum Hydrargyri Oxidi Rubri*, 40 p. c. 6. *Unguentum Stramonii*, 20 p. c.

2. *Ceratum Plumbi Subacetatis*, 20 p. c.

PROPERTIES AND USES.—Lenitive. It is claimed to be absorbed by

the skin more quickly than most fats, hence an excellent base for mercury and other medicines to be administered by inunction. Soothing to the skin and a good base for ointments, as it does not become rancid.

*Derivative Products:*

1. *Glandulæ Suprarenales Siccæ*. **Desiccated Suprarenal Glands, official.**—(Syn., Fr. *Glandes Surrénales desséchées*; Ger. *Getrocknete Nebennieren*.) The suprarenal glands of the sheep or ox, freed from fat, cleaned, dried, and powdered.

*Manufacture:* After removing all external fat and connective tissue the glands are dried as rapidly as possible in a current of warm air at a moderate temperature, and when sufficiently dry are reduced to a coarse powder, and the remaining fat removed by petroleum benzin; all moisture must be removed, by desiccation if necessary, to avoid subsequent putrefaction, after which residue is powdered finely and preserved in well-stoppered bottles. It is a light yellowish-brown powder, slight characteristic odor, partially soluble in water, 1 part represents 6 parts of fresh glands, free from fat, ash 7 p. c. *Test:* 1. Macerate 0.5 Gm. for 15 minutes in water 25 Cc., filtrate should give emerald-green color with few drops ferric chloride T. S., color disappears rapidly.

*Commercial.*—The suprarenal or adrenal gland (body or capsule) of the sheep (ox or pig) is a small glandular follicular body shaped like a cocked hat, and perched as a cap on the top of each kidney. The gland is not confined to the animals above mentioned, but is present in mammals and most other vertebrates, that in man being 2.5–5 Cm. (1–2') long, less in width, and 6 Mm. ( $\frac{1}{4}$ ') thick; it consists of an outer yellowish cortical portion and a very dark inner medullary portion, and while ductless and of unknown function contains abundant bloodvessels, nerves, and lymphatics. They yield their active constituent to boiling water, or to a more or less saturated aqueous solution of boric acid, in which the medicinal properties may remain unimpaired for months. These solutions can readily be made 5–10 p. c., and when 1 Cc. represents 1 Gm. of the fresh gland we have what is recognized as *Extractum Glandularum Suprarenales*. Dose, gr. 3–15 (.2–1 Gm.); dried extract, gr. 1–3 (.06–.2 Gm.).

*Adrenalin*, the supposed active constituent, resides in the medulla of the gland, and has been isolated by T. B. Aldrich and J. Takamine; it is a yellowish-white, stable, alkaline, micro-crystalline powder, slightly bitter, benumbing points of contact on the tongue; turns brown when heated to 205° C. (401° F.), melts, decomposes, and swells at 207° C. (405° F.); readily soluble in most diluted acids and alkalis, slightly soluble in cold water, more soluble in hot water; colorless aqueous solutions easily oxidized by air, changing from pink to red and brown; forms salts (benzoate, hydrochloride, sulphate), each becoming a brown, brittle, amorphous mass, deliquescent.

**PROPERTIES.**—Astringent, hæmostatic, cardiac stimulant, vascular constrictor, muscle tonic, local anæsthetic, poisonous. Some ascribe to the gland a function—the removal and destruction of certain poisons

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from the blood, or the production of an active substance necessary for the maintenance of health. Lessens heart rate, causes a weak pulse to become strong, and an intermittent one regular, stimulates feeble cardiac muscle, has no action on normal heart, and no organic disease contraindicates its use, reduces size of thyroid. Adrenalin is considered about 600 times stronger than the extract, and a solution (of it or its salt) 1 to 10,000 blanches normal conjunctiva within 30–60 seconds.

**USES.**—Locally to nose and throat to reduce congestion and hasten absorption of inflammatory tissue, rhinitis, hay fever, conjunctivitis, keratitis, iritis, ear affections, relieves deafness and tinnitus, hypertrophy of turbinated bodies, (increases effect of cocaine), Addison's disease (characterized by fibro-caseous metamorphosis of suprarenal capsules, brownish-olive coloration of skin, anæmia, prostration), asthma, epistaxis, rickets, exophthalmic goitre, diabetes, anæmia, enlargement of spleen and liver, local vaso-constrictor in minor surgery.

**2. Glandulæ Thyroidæ Siccæ.** Desiccated Thyroid Glands, *official.*—(Syn., Br. Thyroideum Siccum, Dry Thyroid; Ger. Getrocknete Schieldddriisen.) The thyroid glands of the sheep, freed from fat, cleaned, dried, and powdered.

**Manufacture:** Remove external fat and connective tissue from thyroid glands taken from sheep immediately after killing, cut glands across, rejecting any containing cysts, or are hypertrophied, or otherwise abnormal; mince finely the healthy glands, dry at 32–38° C. (90–100° F.), powder dried product, remove all fat by treating with petroleum benzin, dry residue. It is a yellowish, amorphous powder, slight peculiar odor, containing the active ingredients of the thyroid tissue, partially soluble in water, 1 part represents 5 parts of fresh glands, ash 6 p. c. **Tests:** 1. Fuse 1 Gm. in silver dish with sodium hydroxide 1 Gm., oxidizing with potassium nitrate while fusing; dissolve white fused mass in a little water, add sodium nitrite 2 Gm., acidified with nitric acid, shake with chloroform 5 Cc., when latter should become pink to violet (pres. of iodine compounds). 2. Cold extract + sodium nitrite 2 Gm., acidified with nitric acid, should not give iodine test when shaken with chloroform. Should be kept in well-stoppered bottles, to avoid absorption of moisture and subsequent deterioration:

**Commercial.**—The thyroid gland of the sheep is located about the first two tracheal rings; it is 2-lobed, joined by a narrow band (isthmus) in front of the tracheæ, brownish-red, weighing about 2 drachms (8 Gm.); contains thyroidin and iodoglobulin. The extract (*Extractum Thyroidei*) is made with glycerin, 4 glands being represented in each ounce (30 Cc.); this solution is heated with strong phosphoric acid, poured into lime water, and precipitate dried. The solution (*Liquor Thyroidei*, Br.) is made also with glycerin, and preserved with 0.5 p. c. aqueous solution of phenol (carbolic acid); it is a pinkish, turbid liquid, without putrescent odor; 100 minims (6 Cc.) represent one gland.

**PROPERTIES AND USES.**—Influences the processes of nutrition and metabolism, which at present is not understood; in health it is a cir-

culatory sedative or depressant, causing loss of flesh when persisted in; often produces ill-health, wrinkling and changing skin from healthy appearance to a sallow hue. When taking full doses patient should remain in bed, owing to attending depression, which can be abated somewhat by strychnine; causes not only loss of fat, but nitrogenous tissue, hence persons must partake liberally of proteid diet. Dementia, acute mania, exophthalmic goitre.

### BOS TAURUS. THE OX AND COW.

1. FEL BOVIS. Oxgall.

2. SACCHARUM LACTIS. Sugar of Milk,  $C_{12}H_{22}O_{11} + H_2O$ .

**Bos taurus**, *Linné*. { 1. The fresh bile.  
2. Peculiar crystalline sugar from the whey of cow's milk.

*Habitat.* Domesticated; universal.

*Syn.* 1. Fel Tauri, Fel Bovinum, Bilis Bubula, Ox-bile; Fr. Bile (Fiel) de Bœuf; Ger. Ochsen-galle, Rinds-galle. 2. Lactose, Milk-sugar; Fr. Sucre de Lait, Lactine; Ger. Milchzucker.

**Bos.** L. *bos*, *bovis*, fr. Gr. *βοῦς*, an ox—*i. e.*, its classic name.

**Taurus.** L. fr. Gr. *ταῦρος*, a bull, ox—*i. e.*, its classic name.

**ANIMAL.**—Large, 2–3 M. (6–10°) long, 1–1.6 M. (3–5°) high, head low upon a short neck, legs relatively short, hoofs broad, muffle naked, horns unbranched, tail tufted at the tip, inguinal teats.

**I. BILE:** This is separated by liver in the gall-bladder; it is a brownish or dark green viscid liquid, peculiar, unpleasant odor, disagreeable, bitter taste, sp. gr. 1.020; add alcohol to precipitate mucilaginous matter, filter, evaporate off alcohol, when it readily resists putrefaction; 2 drops + 10 Cc. water + 1 drop solution 1 part sugar in 4 water, + sulphuric acid cautiously added until precipitate first formed is redissolved, acquires brownish-red color, changing to carmine, purple, violet. Dose, inspissated bile, gr. 5–15 (.3–1 Gm.).

**CONSTITUENTS.**—Water 85–90 p. c., solids 10 p. c. = mucilage (precipitated by 2 vols. alcohol), bilirubin (cholepyrrhin),  $C_{16}H_{15}N_2O_3$ , and other coloring matters, cholesterin,  $C_{26}H_{44}O$ , lecithin, urea, and salts, among which are the sodium salts of two bitter acids, glycocholic (cholic) and taurocholic (choleic); both when boiled with alkalis yield cholic (cholalic) acid, and the former glycocoll, the latter taurin.

**PREPARATION.**—1. *Fel Bovis Purificatum*. Purified Oxgall. (*Syn.*, Extractum Fellis Bovini; Br. Fel Bovinum Purificatum; Fr. Fiel de Bœuf purifié; Ger. Fel Tauri depuratum, Gereinigte Ochsen-galle.)

*Manufacture:* Evaporate fresh oxgall 300 Gm. to 100 Gm., add alcohol 100 Cc., mix thoroughly, after 3–4 days decant, filter, distil off alcohol, evaporate to pilular consistence. It is a yellowish-green soft solid, peculiar odor, sweet, bitter taste, soluble in water and alcohol. Should remain clear with equal quantity of alcohol (evidence of purity). Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Tonic, laxative, cholagogue, antiseptic, vermifuge; constipation, especially when feces pale color, dyspepsia,

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jaundice ; whenever biliary secretion is deficient ; locally in glandular enlargements.

**II. MILK-SUGAR :** This is found only in mammals' milk, usually to the extent of about .5 p. c. ; obtained mostly in Switzerland, Bavaria, etc., from whey of cheese-making ; the butter and casein are removed, the latter by allowing time for oxidation and generation of lactic acid, or by adding to skimmed milk diluted sulphuric acid, the resulting whey is evaporated to  $\frac{1}{15}$  original bulk, when it is a brown, viscid, sweetly saline mass ; this is put into large tanks or tubs, and in 1-2 days sugar crystallizes in bright yellow granules = *sugar sand*—the process being facilitated by the presence of thin sticks or cords ; the impure crystals may be dissolved in water, decolorized by charcoal and recrystallized. It is in white, hard, crystalline masses or white powder, feeling gritty on tongue, odorless, faintly sweet taste, permanent, ash 0.25 p. c., sp. gr. 1.525, soluble in 4.79 parts water, 1 boiling water, insoluble in alcohol, ether, chloroform, dextrogyrate. *Tests :* 1. Syrup boiled with sodium hydroxide T. S. turns yellowish then brownish-red ; to this add few drops cupric sulphate T. S., getting brick-red precipitate, thus reducing cuprous oxide from alkaline solution of cupric oxide. 2. With sulphuric acid get greenish or reddish, but no brown or black, color within half-hour (abs. of cane-sugar). 3. On boiling with diluted sulphuric acid splits into dextrose and galactose,  $C_6H_{12}O_6$  ; on heating, caramel is obtained. *Impurities :* Heavy metals, cane sugar, starch. Dose,  $\bar{3}\bar{j}$ -5 (30-150 Gm.) per die, in powder or syrup.

**PREPARATIONS.**—1. *Extractum Nucis Vomice*, q. s. 2. *Extractum Opii*, q. s. 3. *Extractum Quassie*, q. s. 4. *Pilule Podophylli, Belladonnæ et Capsici*, 1 gr. (.06 Gm.). 5. *Pulvis Ipecacuanhæ et Opii*, 80 p. c. 6. *Triturationes*.

**PROPERTIES AND USES.**—Diuretic in cardiac dropsy. As a diet in consumption and other wasting diseases. In pharmacy for triturations, powders, etc., for diluent, as it is much harder than cane-sugar, hence aids in comminuting medicines more finely ; it is less sweet than cane-sugar, and not so apt to ferment in the stomach or bowels, hence suitable for infant foods, certain forms of dyspepsia, etc.

*Related Products :*

1. **Gelatinum.** *Gelatin, official.*—(Syn., Fr. *Gélatine* ; Ger. *Gelatina Alba*, *Weisser Leim*.) The purified air-dried product of the hydrolysis of certain animal tissues, as skin, ligaments, and bones, by treatment with boiling water.

*Manufacture :* Gelatinous tissues, as skins, tendons, ligaments, bone-cartilage, bones, hoofs, horns, etc., previously cleansed by washing in cold water, or treatment with dilute alkali solution, are placed on a perforated diaphragm in a boiler, and boiled with water until the collagen becomes soluble, and solution stiffens to a jelly on cooling ; while hot solution is deprived of fat, extraneous matter and impurities by skimming, straining, etc. ; when cold jelly is cut into cakes, which are dried upon nettings. It is an amorphous, more or less transparent solid, usually shredded or in thin sheets, colorless or slightly yellowish,

inodorous, slight characteristic insipid taste, unalterable in air when dry, putrefying rapidly when moist or in solution, soluble in boiling water, acetic acid, glycerin, swells and softens in cold water, absorbing 5–10 times its weight, insoluble in alcohol, ether, chloroform, benzene, carbon disulphide, fixed and volatile oils; dissolved in boiling water (1 in 50) should solidify upon cooling into transparent jelly. *Tests*: 1. Aqueous solution (1 in 5,000) becomes turbid with tannic acid T. S., or with mercuric chloride T. S. 2. Is not precipitated by alum, ferric chloride T. S., or lead acetate T. S. (dis. from chondrin); consists chiefly of glutin, containing carbon 50 p. c., nitrogen 18 p. c., hydrogen 6.5 p. c., oxygen 25 p. c., sulphur 0.5 p. c.; the hardening and binding qualities depend upon amounts of chondrin and gelatones.

**PREPARATION.**—1. *Gelatinum Glycerinatum*. Glycerinated Gelatin. (Syn., Glycerin Jelly; Fr. *Gelée Glycerinée*; Ger. *Glycerinleim*.)

*Manufacture*: Cover over gelatin 100 Gm. with water, previously boiled and cooled, let stand 1 hour, discard water, drain and heat gelatin with glycerin 100 Gm., on water-bath until dissolved, strain and continue heat until product weighs 200 Gm.; when cold cut into pieces, preserve in suitable containers.

**PROPERTIES AND USES.**—Hæmostatic, aneurism, increases coagulability of the blood, when unable to control by pressure or ligature; acts locally and generally in aiding blood coagulation; may be applied to oozing capillaries in 10 p. c. solution, or internally by hypodermic injection, in 1–2 p. c., mixed with normal salt solution (0.9 p. c.); care must always be used to avoid veins and to have the solution sterilized, thereby preventing embolus, infection, tetanus, etc.

2. *Serum Antidiphthericum*. Antidiphtheric Serum, Diphtheria Antitoxin, *official*.—(Syn., Fr. *Serum antidiphthérique*; Ger. *Diphtherie-Heilserum*.) A fluid separated from the coagulated blood of a horse (*Equus caballus*), immunized through the inoculation of diphtheric toxin. The diphtheria bacillus when developing in the body causes the formation of toxins, albumoses, an organic acid, and a substance called antitoxin, which is present in the blood. Frequently the quantity of antitoxin is sufficient to thoroughly antagonize the toxin produced, thereby insuring life; on the other hand, additional antitoxin may have to be introduced in order to save the patient. A culture of diphtheria bacilli may be grown on meat broth in a flask, to which have been added 0.5 p. c. sodium chloride and 2 p. c. peptone. After several weeks the bacilli are filtered off, when the remaining fluid should contain considerable diphtheria toxin of sufficient strength that  $\text{Mjss}$  (.1 Cc.) will kill a guinea-pig. Now of this,  $\text{Mijj-15}$  (.2–1 Cc.) are injected into a vein of a healthy young horse, which produce only slight symptoms; these having disappeared, a larger dose is administered, and increasing doses repeated until  $\text{3ijj}$  (90 Cc.) are given at each injection, thereby insuring a large amount of antitoxin in the blood serum. After several months 1 gallon (4 L.) of blood is withdrawn from the horse into a sterilized vessel, allowed to coagulate, and the antitoxin serum placed in sterilized bottles, with some antiseptic (phenol—carbolic acid), and hermetically sealed. It is a yellowish or

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yellowish-brown, transparent or slightly turbid liquid, odorless or having slight odor due to antiseptic used as a preservative, sp. gr. 1.030 ; gradually loses its power, in one year 10–30 p. c. ; each container should have label giving strength expressed in antitoxin units, name and p. c., by volume, of antiseptic used (if any) for preservation, date when serum last tested, and the date beyond which it will not have the strength as stated. This antitoxic serum should always be injected with a specially devised syringe, preferably between the shoulders or on the side of the abdomen, the skin having been washed with an antiseptic prior to the injection. It is advisable to use small doses of concentrated, rather than large doses of diluted serum, and within the first 24 hours the patient should receive 2,000–4,000 normal units, divided into two or three doses, and each day thereafter the same quantity until improvement is manifest. Every ℥xv (1 Cc.) of serum should contain at least 100 normal units. Erythematous rash, painful and swollen joints, fluctuations in temperature, etc., may follow several weeks after its use.

3. *Streptococcus Antitoxin*.—This serum is prepared similarly to the preceding, using, however, several rabbits, as well as finally the horse, for increasing the virulence, and not bleeding the latter until a year after the first inoculation. These streptococci produce the severe forms of septicemia following the puerperium, after injuries and operations, in erysipelas, scarlet fever, etc. Dose, ʒijss–5 (10–20 Cc.).

4. *Hydrophobia Antidote*.—While this is not a true antitoxin, it is prepared somewhat similarly ; thus a rabbit is inoculated with the spinal cord of an animal that has died of hydrophobia ; from the spinal cord of this rabbit others are inoculated in a series of gradually increasing intensity until the spinal cord contains a virus whose incubation period is seven days. The patient is inoculated first with a rabbit's spinal cord of low degree of virulence, the next day with one of higher intensity, and so increased for several weeks, when one usually is immuned, provided treatment was begun soon after the bite of the rabid dog was received.

*Derivative Products :*

1. *Lac, Milk*.—The secretion by the cow's mammary glands ; white, opaque liquid (emulsion) of minute fat globules suspended in solution of casein, albumin, milk-sugar and inorganic salts, pleasant taste, slight odor ; upon standing few hours the oily globules (cream) owing to lightness separate to the surface ; each is surrounded by an albuminous envelope which may be dissolved by an alkali, thus liberating and permitting aggregation into butter ; contains water 87 p. c., solids 13 p. c.—milk-sugar 4 p. c., butter 4 p. c., casein 4.40 p. c., salts (chiefly phosphates) 0.60 p. c. By churning the fat globules unite to form butter, leaving a liquid called *buttermilk*—solution of milk-sugar, salts, some casein and butter ; skimmed milk develops lactic acid and separates the casein as a coagulum—*curd*, either upon standing (through action of a certain bacterium), or the addition of other acids, or rennet (prepared inner membrane of calf's stomach) ; the liquid separated from the coagulum is *whey*, which contains milk-sugar and salts ; the coagulum upon the addition of salt and proper manipulation gives *cheese*.



Human milk is always alkaline, that of cow's either alkaline or acid. *Humanized Milk* may be prepared by mixing: cream ʒj (30 Cc.), cow's milk ʒiv (15 Cc.), lime water ʒj (30 Cc.), water ʒiiss (45 Cc.), milk-sugar gr. 30 (2 Gm.). *Condensed Milk* is prepared by evaporating milk to the consistence of thick cream (one-fourth its bulk), usually adding sugar for preservation and transportation.

2. *Butyrum, Butter*.—This is obtained by churning the cream rising to the surface of cows' milk. It is soft, yellow, neutral (if acid, due to free butyric acid), sp. gr. 0.930, melts at 32° C. (89.6° F.), congeals at 23° C. (73° F.); odor delicate, sweet; taste bland. Contains olein 30 p. c., palmitin and stearin 68 p. c., about 2 p. c. glycerides of butyric, capronic, caprylic, and caprinic acids. When employed in medicine, should be freed from salt and casein by melting it in warm water and decanting the clear liquid. If 100 parts be saponified by alkali, and the soap decomposed by hydrochloric acid, get fat acids, which, after washing (to remove 8 p. c. volatile fat acids) and drying, weighs 85–88 parts; other fats yield about 95 p. c. of fat acids insoluble in water. Used as demulcent, lenitive, ointment, dietetic.

3. *Extractum Carnis, Extract of Meat*.—Obtained by grinding lean beef into pulpy mass, stirring with equal quantity of water, straining, evaporating in steam-pans over which a current of air is passed continuously, filtering, evaporating to desired consistence; less nutritious than meat, as fat, albumin, much fibrin and gelatin are removed.

4. *Oleum Bubulum, Neat's-foot Oil*.—Obtained by boiling in water the fatty tissue of the feet of the ox, deprived of hoofs, skimming oil from the surface, keeping it some time on warm water for impurities to settle; it is yellowish, peculiar odor; used for softening leather, etc.; for cod-liver oil, but occasions diarrhoea.

5. *Sanguis, Blood*.—This, the arterial fluid of the ox, is red, opaque, peculiar odor, sp. gr. 1.050; consists of blood-corpuscles in suspension; coagulates on exposure, separating the clot (cruor) from the liquid (serum). Contains water 78 p. c., albumin 7 p. c., fibrin 0.4 p. c., corpuscles, hæmoglobin, etc., 13 p. c., salts 0.9 p. c. = alkalies, calcium and magnesium chlorides, phosphates, sulphates; the serum contains 10 p. c. solids—8 p. c. of which are albuminoids. When evaporated have extractum or pulvis sanguinis. Used as restorative. Dose, gr. 5–15 (.3–1 Gm.).

6. *Os, Bone*.—The skeleton of vertebrate animals, official 1850–1880. Bone has a solid, white, smooth, lamellated texture, internally porous, consisting of a cellular gelatinous tissue filled with calcareous deposits (earthy salts). It is insoluble in water, soluble in hydrochloric acid with effervescence, leaving behind a gelatinous mass (ossein); contains calcium phosphate 40–67 p. c., calcium carbonate 5–10 p. c., magnesium phosphate 1–2 p. c., calcium fluoride 1 p. c., traces of Si, Fe, Mn, NaCl. Ossein yields gelatin when boiled with water; when dry distilled get Dippel's animal oil, containing pyridine, picoline, and other bases. Used for preparing animal charcoal (bone-black), phosphates, superphosphates (manure).

## RECAPITULATION No. 11.

Class and family. 1. Latin official name. 2. Eng. official name.	Zoologic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Class <i>Insecta</i> . Family <i>Hemiptera</i> . 1. <i>Coccus</i> . 2. <i>Coccinea</i> .	<i>Pseudococcus</i> cacti.	The dried female insect.	Mexico, C. America.	Carminic acid, coccin, fat.	Tinct. card. comp.	Stimulant, diuretic, antispasmodic.	Whooping-cough, neuralgia, for coloring preparations.	Grains. 1-15 (.06-1 Gm.).
Class <i>Insecta</i> . Family <i>Coloptera</i> . 1. <i>Cantharis</i> . 2. <i>Cantharides</i> .	<i>Cantharis vesicatoria</i> .	The dried beetle.	S. and C. Europe, W. Asia.	Cantharidin, fat, odorous compound, extractives, salts.	Cerate. collodion canth., tincture.	Diuretic, aphrodisiac, emmenagogue, rubefacient, acrid poison.	Dropsy, bronchitis, bladder debility, gleet, diabetes, amenorrhoea, ulcers, brain congestion, pleurisy, dysmenorrhoea, rheumatism, tetanus, apoplexy, meningitis.	$\frac{1}{8}$ -1 (.01-.06 Gm.).
Class <i>Insecta</i> . Family <i>Hymenoptera</i> . 1. <i>Mel</i> . 2. <i>Honey</i> .	<i>Apis mellifera</i> . .....	A saccharine secretion.  A solid substance from the honey-comb.	N. America, Europe. .....	Grape-sugar, wax, vol. oil, proteids, mucilage, formic acid, coloring.  Hydrocarbons, cerin, myricin.	Clarified honey, mel rose, confection rose.  Resin cerate, canthar. cerate, ointment, ointment of fat, white wax.	Demulcent, laxative, stimulant, nutritive.  Protective, demulcent, emollient.	Aphthae, thrush, boils, fissures.  Plasters, cerates, ointments, diarrhoea, neuralgia, gleet, protective.	Ad libitum.  Externally.
Class <i>Pisces</i> . Family <i>Racostia</i> . 1. <i>Oleum Morrhuae</i> . 2. <i>Cod-liver Oil</i> .	<i>Gadus Morrhua</i> .	A fixed oil.	N. Atlantic Ocean.	Olein, palmitin, stearin, iodine, ascarin, morrhaine, chlorine, bromine, phosphorus.	Emulsion, emulsion with hypophosphites.	Alterative, demulcent, nutritive.	Wasting diseases, phthisis, bronchitis, rheumatism, skin affections, diarrhoea, neurasthenia, scrofula, arthritis (gout).	Minims. 3j-4 (4-15 Cc.).

## RECAPITULATION No. 11.—(Continued.)

Class and family. 1. Latin official name. 2. Eng. official name.	Zoölogic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Class <i>Mammalia</i> . Family <i>Cetacea</i> . 1. Cetaceum. 2. Spermæcti.	Physeter macrocephalus.	A concrete fat.	Pacific and Indian Oceans.	Cetyllic alcohol combined with palmitic acid.	Cold cream.	Lentitive, demulcent, emollient.	Base of cerates, ointments, etc., urinary irritation.	
Class <i>Mammalia</i> . Family <i>Pachydermata</i> . 1. Adeps. 2. Lard.	Sus scrofa var. domesticus.	The internal fat.	Universal.	Olein, palmitin, starch.	Benz lard cerate, ointment. <i>Oil</i> : many cerates, ointments.	Emollient poultices.	To protect surfaces.	
1. Pancreatinum. 2. Pancreatin. 1. Pepsinum. 2. Pepsin.	..... .....	Unorganized ferment. Unorganized ferment.	..... .....	..... .....	..... .....	Ferment. Ferment.	Dyspepsia, indigestion. (3-1 Gm.). Dyspepsia, indigestion, diarrhœa. (3-2 Gm.).	Grains. 5-15 (3-1 Gm.). 5-80 (3-2 Gm.).
Class <i>Mammalia</i> . Family <i>Ruminantia</i> . 1. Moschus. 2. Musk.	Moschus moschiferus.	The dried secretion from the preputial follicles.	C. Asia.	Ammonia, acid, fat, cholesterin, gelatinous and albuminous principles.	Tincture.	Antispasmodic, nervine, anodyne, stimulant, aphrodisiac.	Typhoid, pneumonia, convulsions, hiccough, croup, whooping-cough, nausea, colic, hysterics, tetanus, rheumatism, sprains.	1-10 (0.5-6 Gm.).
1. Sebum Prep. 2. Prepared Suet. 1. Adeps Lanae. 2. Wool-Fat.	Ovis arles.	The internal fat. The purified fat of the wool.	Universal.	Stearin, palmitin, olein, hircin. Cholesterin, ethers of stearic, palmitic, oleic, valeric (valerianic) acids.	Ointment of mercury. Hydrous wool-fat.	Lentitive.	Dressing blisters, excoriated surfaces, chapped hands.	Externally.
1. Fel Bovis. 2. Oxgall.	Bos taurus.	The fresh bile.	Universal.	Bilirubin, cholesterin, lecithin, cholic and choleic acids, mucilage.	Purified oxgall.	Tonic, laxative, cholagogue, antiseptic, vermifuge.	Constipation, dyspepsia, jaundice, glandular enlargements.	Grains. 5-15 (3-1 Gm.).

## PART III.

### INORGANIC DRUGS FROM THE MINERAL KINGDOM.

#### I. METALLOIDS AND THEIR COMPOUNDS.

##### HYDROGEN AND OXYGEN.

$H^I = 1.$

$O^{II} = 16.$

THE elements, hydrogen (Gr. *ὕδωρ*, water, + *γενής*, producing) and oxygen (Gr. *ὀξύς*, acid, sharp, + *γενής*, producing), in their free state, seldom are used in medicine, but when combined one with the other, or either of these with other elements, we come in possession of an almost endless list of agents—many being of the utmost importance. Hydrogen and oxygen combine with acid and basic substances, the former producing hydrates, the latter oxides.

**Aqua.** Water,  $H_2O$ .—(Syn., Hydrogen Monoxide; Fr. Eau; Ger. Aqua communis, Wasser.)

Potable water in its purest attainable state. By this the U. S. P. means any water—be it rain (*aqua pluvialis*), snow (*aqua nivalis*), spring (*aqua fontana*), river (*aqua fluvialis*), or lake (*aqua lacalis*)—which is suitable for drinking, that does not curdle soap, contains no heavy metals, and only limited amounts of ammonia, ammoniacal or acid vapors, soluble salts, chlorides, nitrates, nitrites, sulphates, organic or other oxidizable substances. It is a colorless, limpid liquid, odorless, tasteless at ordinary temperatures, odorless when heated, neutral to litmus.

**PREPARATION.**—1. *Aqua Destillata*. Distilled Water,  $H_2O$ . (Syn., Fr. Eau distillée, Hydrolat simple; Ger. Destillirtes Wasser.)

**Manufacture:** By distilling water 1,000 vols. and reserving the intermediate 800 vols. The first 100 vols. are liable to contain volatile substances, the last 100 vols. solid and organic matter, hence both are rejected. It is a colorless, odorless, tasteless, neutral, limpid liquid, and should contain none of the following or above-mentioned likely impurities nor any carbonic acid. **Tests:** 1. With hydrogen sulphide or ammonium sulphide (heavy metals); ammonium oxalate T. S. (calcium); silver nitrate T. S. (chlorides). 2. Barium chloride T. S. (sulphate); mercuric chloride (ammonia); calcium hydroxide (carbonic acid); sulphuric acid + potassium permanganate + heat (organic matter), evaporate (residue).

The purer water the softer ; hard water curdles soap from presence of calcium (sulphate, carbonate) or magnesium salts, consequently it is poorly adapted for domestic use.

PROPERTIES.—Demulcent, diuretic, diaphoretic, solvent, diluent.

Vapor bath accelerates circulation, causes profuse sweating.

Hot bath stimulates, producing redness of face and skin.

Warm bath slows respiration, reduces body temperature, relaxes skin, causes sleep. Valuable in febrile exanthematous diseases.

Cold bath abstracts heat, sometimes stimulant, tonic, sedative. Popular and very useful in febrile conditions, especially typhoid.

MINERAL WATERS.—In addition to the two preceding official waters a number of natural waters are used medicinally, which contain one or more chemicals, being named according to some active ingredient or therapeutic value. Thus we have :

Alkaline waters, containing  $\text{NaHCO}_3$  (usually predominates),  $\text{NaCl}$ ,  $\text{Na}_2\text{SO}_4$ , and often free  $\text{CO}_2$ —Vichy, Kissingen, Carlsbad, Ems, Saratoga.

Chalybeate Waters, containing  $\text{FeSO}_4$ ,  $\text{Fe}_2\text{CO}_3$ —Wiesbaden, Brighton, Spa, Bedford, Rockbridge Alum.

Hepatic or Sulphur Waters, containing  $\text{H}_2\text{S}$ —Aix-la-Chapelle, White Sulphur, Blue Lick, Sharon, Richfield.

Bitter Waters, containing  $\text{MgSO}_4$ ,  $\text{MgCl}_2$ —Hunyadi, Friedrichshall.

Carbonated Waters, containing  $\text{Ca}$ ,  $\text{Mg}$ ,  $\text{Fe}$ —carbonates held in solution by  $\text{CO}_2$ —Seltzer, Apollinaris, Old Sweet, etc.

Lithia Waters, containing lithium salts—Buffalo, Londonderry, Magnetic.

The list of such springs is lengthy, and all are asserted to be specific for one or more ailments. To obtain the benefit asserted, it is always best to visit the spring itself, and there, free from cares, worries, etc., drink the waters under the directions of a resident physician.

**Aqua Hydrogenii Dioxid.** Solution of Hydrogen Dioxide,  $\text{H}_2\text{O}_2$ .—(Syn., Oxygenized Water, Oxygen Hydrate ; Br. Liquor Hydrogenii Peroxidi, Solution of Hydrogen Peroxide ; Fr. Soluté de Peroxide d'Hydrogen ; Ger. Wasserstoff Hyperoxidlösung.)

*Manufacture:* Barium dioxide 300 Gm. are dissolved (or hydrated to a magma, by shaking vigorously) in cold distilled water 500 Cc., being chilled to  $10^\circ \text{C}$ . ( $50^\circ \text{F}$ .). Now dissolve phosphoric acid 96 Cc. in distilled water 320, and to this add the hydrated magma in four portions, shaking and keeping cool ; when neutral, filter, wash with distilled water until filtrate is 1,000 Cc., add 30 drops diluted sulphuric acid to filtrate + starch 10, agitate, filter— $\text{BaO}_2 + 2\text{H}_3\text{PO}_4 = \text{Ba}(\text{H}_2\text{PO}_4)_2 + \text{H}_2\text{O}_2$ . This liquid is a slightly acid, aqueous solution of hydrogen dioxide,  $\text{H}_2\text{O}_2$ , containing when freshly prepared about 3 p. c. by weight of pure dioxide, corresponding to 10 volumes of available oxygen. It is colorless, odorless ; slightly acidulous taste, producing peculiar sensation and soapy froth in the mouth ; deteriorates upon keeping or protracted shaking, which is retarded by replacing stopper

by pledget of cotton ; at ordinary temperature and when heated to 60° C. (140° F.) decomposes into  $H_2O + O$  ; if heated rapidly have explosive violence. *Tests*: 1. To 10 Cc. water add 1 drop potassium chromate T. S., + 10 drops diluted sulphuric acid, pour few Cc. ether on top, + few drops of solution hydrogen dioxide, gives blue color at zone of contact of two liquids ; after shaking, the ether-layer separates with blue color. *Assay*: 10 Cc. + distilled water q. s. 100 Cc. ; to 16.9 Cc. of this + 5 Cc. diluted sulphuric acid, add  $\frac{N}{10}$  potassium permanganate V. S., slowly until faint pink tint is permanent (each Cc. of V. S. consumed corresponds to 0.1 p. c. absolute hydrogen dioxide, or 0.329 volumes of oxygen ; 30 Cc. should be required). *Impurities*: Heavy metals, arsenic, barium, free acids, hydrofluoric acid, total solids. Should be kept cool, and upon removing stopper only slight pressure should be observed. Dose, ʒj-3 (4-12 Cc.).

**PROPERTIES.**—Oxidizant, stimulant (nervous system), increases urine, antiseptic, decomposes pus, kills microbes, prevents fermentation.

**USES.**—Diabetes, atonic dyspepsia, dyspnœa, epilepsy, low fevers, whooping-cough, asthma, phthisis, anæmia, chlorosis, pneumonia ; locally, in mucous membrane inflammations, wounds, ulcers, ozæna, ophthalmia, gonorrhœa, leucorrhœa, chancres, otorrhœa, rhinitis, diphtheria, bronchitis, fetid breath, cystitis, spray, gargle. *Pyrozone* is claimed to be 50 p. c. When hydrogen dioxide is dissolved in glycerin instead of water, we have *glycozone*.

## NITROGEN.

$$N^{III} = 14.$$

The element nitrogen (Gr. *νίτρον*, L. *nitrum*, niter, + *γενήζ*, *γένεσις*, produced from or generator of) is of considerable importance in medicine, owing to its ready combination with hydrogen and oxygen, thus forming several useful official compounds.

**Aqua Ammonia.** **Ammonia Water**,  $NH_4OH$ .—(Syn., Spirit of Hartshorn ; Br. *Liquor Ammonia*, *Spiritus Salis Ammoniaci Causticus*, *Ammonia Aqua Soluta* ; Fr. *Ammoniaque liquide*, *Eau* (Solution, Liqueur) *d'Ammoniaque* ; Ger. *Liquor Ammonii caustici*, *Ammoniakflüssigkeit*, *Salmiakgeist*, *Aetzammoniak*.) An aqueous solution of ammonia,  $NH_3$  containing 10 p. c., by weight, of gaseous ammonia.

*Manufacture*: Heat gradually ammonium chloride and calcium hydroxide mixed together, and pass the gas thus generated into water— $2NH_4Cl + Ca(OH)_2 = CaCl_2 + 2H_2O + 2NH_3$ . It is a colorless, transparent, pungent, irritating, alkaline liquid, sp. gr. 0.958, volatile, no residue, fumes in the presence of hydrochloric acid. *Assay*: Weigh 3 Cc., add 50 Cc. distilled water, titrate with normal sulphuric acid V. S., using litmus or methyl-orange T. S. indicator ; multiply number Cc. of V. S. consumed by 0.1693, divide product by weight of ammonia water taken, the quotient = p. c. ammonia gas present. *Impurities*: Heavy metals,

chlorides, sulphates, carbonic acid, empyreumatic odor or red color, readily oxidizable substances, coal-tar bases, fixed substances. Should be kept cool, in glass-stoppered bottles; should be tested frequently as it deteriorates on keeping, and must not be dispensed when less than official strength (10 p. c.). Dose,  $\text{M}_x$ -20 (.6-1.3 Cc.), well diluted.

PREPARATIONS.—1. *Linimentum Ammoniae*. Ammonia Liniment. (Syn., Volatile Liniment; Fr. Liniment (Savon) ammoniacal (volatil); Ger. Flüchtigtes Liniment, Flüchtige Salbe.)

*Manufacture*: 35 p. c. Mix by agitation ammonia water 35 Cc. with alcohol 5, cottonseed oil 57, oleic acid 3; should be freshly prepared when wanted; used externally.

2. *Spiritus Ammoniae Aromaticus*. Aromatic Spirit of Ammonia. (Syn., Spiritus Ammoniae Compositus, Spirit of Sal Volatile; Fr. Alcoolat ammoniacal aromatique; Ger. Aromatischer Ammoniakgeist.)

*Manufacture*: To ammonia water 9 Cc. add distilled water 14, then ammonium carbonate 3.4 Gm.; to alcohol 70 Cc. add oil of lemon 1, oil of lavender flowers .1, oil of nutmeg .1, then the ammonia solution, and finally distilled water q. s. 100 Cc., filter. It is nearly colorless, darkens with age, pungent, ammoniacal odor and taste, sp. gr. 0.900. Dose,  $\text{M}_x$ -60 (.6-4 Cc.), well diluted.

Preps.: 1. *Tinctura Guaiaci Ammoniata*. Guaiac 20 Gm., aromatic spirit of ammonia q. s. 100 Cc. 2. *Tinctura Valerianae Ammoniata*. Valerian 20 Gm., aromatic spirit of ammonia q. s. 100 Cc.

PROPERTIES.—Stimulant, antacid, irritant, rubefacient, caustic, corrosive poison; before meals increases, but after neutralizes gastric juice.

USES.—Heartburn, nauseating headache, stimulates circulation and respiration, paralyzes the heart muscle. It is oxidized in the system, forming nitric acid, which is eliminated by kidneys; externally in rheumatism, neuralgia, congestion of larynx, throat, bowels, amenorrhœa, burns, frostbite, vulvular pruritus, syncope, bronchitis, hoarseness, acidity, whooping-cough, stings (of bees, mosquitoes, spiders, wasps, etc.); antidote to chlorine, bromine, hydrocyanic acid, alcoholic intoxication. Mixed with oil should be applied by gentle friction.

*Poisoning*: Have burning pain from mouth to stomach; difficult deglutition, vomiting and purging of blood and mucus, cold and clammy skin, feeble pulse, collapse, sense of suffocation, convulsions, stupor, coma. Give vegetable acids (vinegar, lemon-juice), oil, demulcents, stimulants (atropine, strychnine, digitalis, brandy, etc.), opium for the pain.

*Synergists*: Cardiac and diffusible stimulants, antispasmodics, capicum, cantharides, counter-irritants.

**Aqua Ammonia Fortior.** Stronger Ammonia Water,  $\text{NH}_4\text{OH}$ . —(Syn., Br. Liquor Ammoniae Fortis; Fr. Eau d'Ammoniaque forte; Ger. Stärker Salmiakgeist.) An aqueous solution of ammonia ( $\text{NH}_3$ ), containing 28 p. c., by weight, of gaseous ammonia.

*Manufacture*: Same as aqua ammoniae, only much more ammonia

(gas) is required to give the 28 p. c. saturation. It is a colorless, transparent liquid, having an intensely pungent odor, very caustic and alkaline taste, alkaline reaction, sp. gr. 0.897; diluted with twice its volume of distilled water should respond to reactions and tests of aqua ammoniæ. Should be kept cool, in partially filled, strong, glass-stoppered bottles, and great caution should be used in handling. Dose, ℥ij-6 (.2-4 Cc.), well diluted.

**PREPARATIONS.**—1. *Spiritus Ammoniaæ*. Spirit of Ammonia. (Syn., Spiritus Ammoniaci Caustici Dezondii, Ammoniated Alcohol; Fr. Alcoolé d'Ammoniaque, Liqueur d'Ammoniaque vineuse; Ger. Liquor Ammonii caustici (Spirituosus, Weingeistige), Ammoniakflüssigkeit.) An alcoholic solution of ammonia ( $\text{NH}_3$ ), containing 10 p. c., by weight, of the gas.

**Manufacture:** Heat carefully stronger ammonia water 25 Cc. to 60° C. (140° F.) until ammonia ceases to be evolved, condensing the gas therefrom in alcohol 50 Cc., in a well-cooled receiver, disconnect receiver, ascertain strength by assay, add alcohol to make product contain 10 p. c., by weight, of ammonia gas. It is a colorless liquid, strong odor of ammonia, sp. gr. 0.808. **Assay:** Weigh 2 Cc., add 50 Cc. distilled water, titrate with  $\frac{N}{2}$  sulphuric acid V. S., using litmus T. S. indicator; multiply number Cc. of V. S. consumed by 0.008465, the product by 100, divide by weight taken, product = p. c. of ammonia gas. Should be kept cool, in glass-stoppered bottles, and must not be dispensed when less than official strength (10 p. c.). Dose, ℥x-30 (.6-2 Cc.), well diluted.

**PROPERTIES AND USES.**—Too strong for internal use unless largely diluted.

**Externally**—rubefacient; should be mixed with spirit of camphor, oil of rosemary, etc., for rheumatism, neuralgia, spasmodic and inflammatory affections.

**Spirit:** This is stimulant, antispasmodic; given in hysteria, flatulent colic, nervous debility, nauseating headache.

**Acidum Nitricum.** Nitric Acid,  $\text{HNO}_3$ .—(Syn., Acidum Nitri, Acidum Azoticum, Spiritus Nitri Acidus, Spirit of Nitre, Aqua Fortis; Fr. Acide nitrique, Acide azotique; Ger. Salpetersäure.) A liquid composed of 68 p. c., by weight, of absolute nitric acid ( $\text{HNO}_3$ ) and 32 p. c. of water.

**Manufacture:** It is obtained by combining nitrogen pentoxide with water— $\text{N}_2\text{O}_5 + \text{H}_2\text{O} = 2\text{HNO}_3$ ; or by double decomposition between potassium nitrate or sodium nitrate and sulphuric acid, with heat— $\text{NaNO}_3 + \text{H}_2\text{SO}_4 = \text{HNO}_3 + \text{NaHSO}_4$ , or  $2\text{NaNO}_3 + \text{H}_2\text{SO}_4 = 2\text{HNO}_3 + \text{Na}_2\text{SO}_4$ . It is a colorless, volatile, fuming, caustic, corrosive, suffocating liquid, sp. gr. 1.403, boils at 120° C. (249° F.). **Tests:** 1. Dissolves copper, mercury, silver, etc., with evolution of red fumes; stains woolen fabrics and animal tissues yellow; discharges blue color from indigo T. S. **Assay:** Weigh accurately 3 Cc., dilute with 50 Cc. distilled water, titrate with normal potassium hydroxide V. S., using methyl-orange T. S. indicator, multiply number Cc. of V. S. consumed



by 6.257, divide product by weight of acid taken, quotient = p. c. of absolute acid. *Impurities*: Heavy metals, arsenic, iodine, bromine, sulphuric, hydrochloric, iodic, and bromic acids, non-volatile substances. Should be kept in glass-stoppered bottles. Dose, Mij-5 (.13-.3 Cc.), well diluted.

**PREPARATIONS.**—1. *Acidum Nitricum Dilutum*. Diluted Nitric Acid. (Syn., Fr. Acide Azotique dilué; Ger. Verdünnte Salpetersäure.)

*Manufacture*: Mix nitric acid 100 Gm., distilled water 580 Gm.; contains 10 p. c., by weight, of absolute nitric acid, sp. gr. 1.054. *Assay*: To neutralize 6.26 Gm. should require 10 Cc. normal potassium hydroxide V. S. (each Cc. of V. S. corresponding to 1 p. c. of absolute acid), using methyl-orange T. S. indicator. *Tests and Impurities*: Same as for strong acid. Should be kept in dark amber-colored, glass-stoppered bottles. Dose, Mij-5 (.13-.3 Cc.), well diluted. Fuming nitric acid contains 86 p. c. of  $\text{HNO}_3$ , is clear, reddish-brown, giving off yellowish-red fumes, sp. gr. 1.486; commercial nitrous acid is similar but weaker, consisting of nitric acid colored red by nitrogen tetroxide.

2. *Acidum Nitrohydrochloricum*. Nitrohydrochloric Acid. (Syn., Nitromuriatic Acid, Aqua Regia (Regis); Fr. Acide Chloro(azotique)-nitreux, Eau régale; Ger. Acidum Chloro-nitrosium, Salpetersalzsäure, Königswasser.)

*Manufacture*: Mix gradually nitric acid 18 Cc., hydrochloric acid 82 Cc., allowing effervescence to cease. The two acids act chemically upon each other, forming water and a chlorinated oxide of nitrogen, liberating chlorine, upon the presence of which in a free state the great dissolving power depends— $\text{HNO}_3 + 3\text{HCl} = \text{NOCl} + \text{H}_2\text{O} + \text{Cl}_2$ ; the nitrosyl chloride, NOCl, is a yellowish gas, becoming red at  $-5^\circ \text{C}$ . ( $23^\circ \text{F}$ ). It is a golden-yellow, fuming, corrosive liquid, chlorine odor, volatile, dissolves gold leaf, 1 drop liberates iodine from potassium iodide T. S.; contains 38.5 p. c. of absolute acid. Should be kept cool, in half-filled, glass-stoppered, dark amber-colored bottles. Dose, Mij-5 (.13-.3 Cc.), well diluted.

**Prep.**: 1. *Acidum Nitrohydrochloricum Dilutum*. Diluted Nitrohydrochloric Acid. (Syn., Diluted Nitromuriatic Acid; Fr. Acide Chlorazotique dilué; Ger. Verdünnte Salpetersalzsäure.)

*Manufacture*: Mix nitric acid 4 Cc., hydrochloric acid 18.2 Cc., distilled water 78 Cc., allow effervescence to cease.

This is very similar to the preceding, but properties weaker, chlorine odor faint; contains 8.5 p. c. of absolute acid. Should be kept with same precautions, and not dispensed unless recently prepared. Dose, Mv-30 (.3-2 Cc.), well diluted.

**PROPERTIES.**—Tonic, antiseptic, astringent, cholagogue, escharotic; stains yellow.

**USES.**—Intestinal indigestion with diarrhoea, syphilis, chronic hepatitis, intermittents, jaundice, scrofula, dysentery, whooping-cough, bronchitis, to allay thirst in fever, diabetes, diminishes phosphatic deposits in urine, gravel. Externally to destroy chancres, warts, hemorrhoids,

phagedenic ulcers, bites of snakes and rabid dogs, tests for albumin in urine. As a lotion for ulcers, chilblains, and antiseptic purposes. Checks secretion of hydrochloric acid if given before meals.

*Poisoning*: Have burning acute pain over the entire affected tract, hiccough, nausea, vomiting (dark-colored mucous shreds, blood, etc.), swollen, tender cold abdomen, feeble pulse, clammy skin, difficult respiration, intense thirst; nearly always fatal. Give antidotes (alkaline solutions of sodium carbonate or bicarbonate, magnesium oxide, chalk), soap, mucilaginous drinks, almond or olive oil, emollient fomentations, morphine, stimulants, heat, avoid use of pump.

*Incompatibles*: Alcohol, alkalies, carbonates, oxides, ferrous sulphate, lead acetate.

## CARBON.

C<sup>iv</sup> = 12.

The element carbon (L. *carbo*, coal, Skt. *cra*, to cook) in the free state is of the greatest service in its several forms (official and non-official), while in combination it is of infinite importance, as it enters into the composition of many medicinal compounds.

**Carbo Ligni. Charcoal.**—(Syn., Vegetable Charcoal, Carbo Præparatus, Carbo e Ligno; Br. Wood Charcoal; Fr. Charbon végétal, Charbon de Bois; Ger. Carbo Ligni pulveratus, Gepulverte Holzkohle, Präparirte Kohle.)

*Manufacture*: Charcoal is prepared from soft wood (willow, poplar, etc.) by exposure to red heat (300° C.; 572° F.) without access of air, then very finely powdered. In burning wood thus in a retort or under turf, the hydrogen and oxygen are driven off, leaving only carbon; if much air be admitted, will have also considerable ash. Charcoal yields when burnt ash 1–2 p. c. It is black, odorless, tasteless, non-gritty, very light, not affected by reagents. *Test*: 1. If 1 Gm. be boiled with 3 Cc. potassium hydroxide T. S. + 5 Cc. water, should have a colorless filtrate (showing complete carbonization). Should be kept in well-closed vessels. Dose, gr. 15–60 (1–4 Gm.).

**PREPARATIONS.**—(Unoff.) *Lozenges. Biscuit. Capsules.* Mostly taken in water.

**PROPERTIES.**—Disinfectant, absorbent, deodorizer, decolorizer. Absorbs gases, condensing them within its pores, especially oxygen. When thus condensed, charcoal has an oxidizing action like ozone, parting readily with its oxygen in the presence of oxidizable substances. It easily oxidizes H<sub>2</sub>S, thus decomposing organic matter when in the dry form.

**USES.**—Diarrhœa, dyspepsia with fetid breath, gastralgia, pyrosis, diabetes, constipation, nausea, intermittent fevers, worms, large doses purgative. Externally in dressing wounds, ulcers, gangrenous sores, fetid stools in typhoid fever, etc.

**Carbo Animalis.** **Animal Charcoal.**—(Syn., Bone-black, Ivory-black, Carbo Ossium, Ebur Ustum, Spodium; Fr. Charbon animal, Noir d'Os; Ger. Thierkohle, Knochenkohle, Beinschwarz.)

*Manufacture:* Animal charcoal is prepared from bone by exposing it to a red heat without access of air, and consists of carbon 10 p. c. + calcium carbonate and phosphate 85–90 p. c. The bones are boiled first in water to remove fat, then put in iron cylinders and subjected to intense heat; the volatile products are gases; in addition there is an ammoniacal aqueous liquid—bone spirit, and a blackish tar called bone oil. Charcoal is a dull-black granular or fine powder, odorless, nearly tasteless, insoluble in water or alcohol, and when ignited yields grayish ash 85 p. c., which should be soluble in HCl with aid of heat. *Test:* 1. 1 Gm. boiled several minutes with 3 Cc. potassium hydroxide T. S. + 5 Cc. water should give a colorless filtrate (showing complete carbonization.)

**PREPARATION.**—1. *Carbo Animalis Purificatus.* Purified Animal Charcoal. (Syn., Fr. Charbon animal purifié; Ger. Gereinigte Knochenkohle.)

*Manufacture:* Boil gently for 10 hours animal charcoal 100 Gm., hydrochloric acid 300 Gm., water 600 Cc., adding more occasionally to maintain this volume, filter, wash residue with boiling water 1,200–1,500 Cc., dry in an oven, and immediately transfer it to well-stoppered bottles; the acid dissolves out the earthy salts (calcium carbonate and phosphate). It is a dull black, odorless, tasteless, insoluble powder. *Tests:* 1. Ignite 2 Gm., getting residue 0.08 Gm., or 4 p. c. of the original weight (lim. of silicates and other fixed inorganic matter). 2. Boiled with diluted potassium hydroxide T. S., filtrate should be colorless (showing complete carbonization). Dose, gr. 15–60 (1–4 Gm.), mostly as an antidote.

**USES.**—By reason of its property of absorbing coloring matter it is used in the preparation of organic alkaloids to decolorize them in aqueous solutions. The colored decoction or infusion is boiled or percolated with the charcoal, which not only absorbs the coloring matter, but frequently a portion of the alkaloids—in fact, quite all of some active constituents may be extracted by this process. After boiling with charcoal, this latter is washed, dried, and then digested in boiling alcohol, which is reclaimed, leaving as a residue the alkaloid, bitter principle, etc. By this process have been extracted arnicin, colocynthin, calumbin, digitalin, ilicin, scillitin, quinine, strychnine, etc., while lime, iodine, basic lead and other metallic salts may likewise be removed.

In poisoning by opium, aconite, or strychnine, as an antidote should give of the purified charcoal at least ʒss (15 Gm.) for each grain (.06 Gm.) of the alkaloid; the charcoal should be left in the stomach about 10 minutes, and then removed by a pump or emetic. Should not remain, however, too long, as the alkaloid will be redissolved, and enter into circulation.

**Carbonei Disulphidum.** Carbon Disulphide,  $\text{CS}_2$ .—(Syn., Br. Carbonis Bisulphidum, Carbon Bisulphide (Sulphide); Fr. Sulfure de Carbone; Ger. Carboneum Sulfuratum, Alcohol Sulfuris, Schwefelkohlenstoff, Schwefelalkohol.)

**Manufacture:** Carbon disulphide is made by dropping sulphur upon red-hot charcoal in a furnace; the sulphur, liquefying and vaporizing, combines with the carbon, and the  $\text{CS}_2$  formed distils over through condensing tubes, where it remains, while the  $\text{H}_2\text{S}$  formed at the same time passes beyond and escapes. It has to be agitated with milk of lime, litharge, chlorinated lime, powdered corrosive sublimate, or copper sulphate, decanted, 2 p. c. of a bland fixed oil or beeswax added, and then rectified in order to eliminate free sulphur and disagreeably smelling sulphur compounds. It is a clear, colorless, refractive, diffusive liquid, of strong, characteristic, but not fetid odor, sharp, aromatic taste, soluble in alcohol, ether, chloroform, fixed and volatile oils, 526 parts water, sp. gr. 1.256. **Tests:** 1. Should not change blue litmus (abs. of sulphur dioxide), nor leave a residue (abs. of dissolved sulphur), nor blacken with lead acetate T. S. (abs. of hydrogen sulphide). Should be kept cool, remote from lights or fire, in partially filled, well-stoppered bottles or tin cans. Dose,  $\text{Mv}$ —15 (.3–1 Cc.), well diluted.

**PROPERTIES.**—Anæsthetic, rubefacient, antiseptic, anodyne, refrigerant, irritant, poisonous; mostly used externally. Workmen exposed to its fumes have headache, vertigo, nervousness, voluble talking, incoherent singing, laughing, weeping, weakness, loss of sexual power, impaired vision, hearing and memory, death.

**USES.**—Locally, blunts sensibility, hence used in opening abscesses, evulsion of nails, also to relieve headache, toothache, neuralgia, enlarged lymphatic glands, goitre, lupoid, syphilitic growths, deafness due to want of nervous energy; to dissolve rubber, oils, etc.; internally, for pain of gastric cancer, nausea, vomiting, gastralgia, enteric fever.

**Poisoning:** Overdose acts as a powerful narcotic poison, causing sleep, coma, running, rapid, feeble pulse, stertorous respiration, loss of reflex action, cold, clammy sweat, low temperature, death. Give emetic, potassium bromide, hydrated chloral, stimulants, inhale ammonia, warmth to body, cold douche to head, artificial respiration.

## SILICUM. SILICON.

$$\text{Si}^{17} = 28.3$$

The element silicon (*L. silex, silicis*, flint, which is nearly all silica = silicon oxide), like boron, resembles carbon. It is infusible, insoluble, non-volatile, and is met with in crystals as well as amorphous. It occurs mostly as silicon dioxide (silica),  $\text{SiO}_2$ —agate, amethyst, chalcedony, flint, quartz, rock crystal, sand, but also as silicates, which are silicic acid having its hydrogen replaced by metals—basalt, feldspar, granite, mica, porphyry, etc. Sodium silicate is the only compound of medicinal importance, although potassium silicate possesses very similar

properties; this latter salt is prepared by fusing together potassium carbonate 10 parts, fine sand 15, charcoal 1.

**PREPARATION.**—(Unoff.) *Liquor Sodii Silicatis*. Official 1880–1900. Made by fusing 1 part of fine sand or flint with 2 parts of dried  $\text{Na}_2\text{CO}_3$ , lixiviating the product with boiling water, filtering and evaporating. It is a semitransparent, yellowish or greenish viscid liquid, odorless, taste sharply saline, alkaline, sp. gr. 1.350; contains 33 p. c. of sodium trisilicate and tetrasilicate mixed; with nitric acid gives precipitate of silicic hydroxide. Should be kept in well-stoppered bottles.

**PROPERTIES AND USES.**—Sodium silicate is claimed valuable in arresting organic fermentation and putrefaction. *Liquor*—deodorant, antiseptic, antiferment, astringent, stimulant; chiefly in surgery for making fixed bandages for fractures, coating in erysipelas, like colodion, injection in gonorrhœa, etc.

## BORON.

$$\text{B}^{\text{III}} = 11.$$

The element boron (L. *bor(ax) + on*, fr. *baraga*, shine, glisten, substance from which the element first was obtained) resembles carbon very closely. It is infusible, non-volatile, insoluble, and is found sparingly in nature. Occurs as either boric (boracic) acid or sodium borate (borax). Chiefly in Italy and California.

**Acidum Boricum.** Boric Acid,  $\text{H}_3\text{BO}_3$ .—(Syn., Boracic Acid, Acidum Boracicum; Fr. *Acide borique* (crystallisé); Ger. *Borsäure*.)

**Manufacture:** Occurs in nature free and combined, but for medicine is prepared usually by dissolving sodium borate (borax) 10 parts in

FIG. 437.



Boric acid crystal.

water 24, filtering while hot and adding hydrochloric acid 6; crystallize in a cool place, wash crystals with little cold water to remove adhering acid— $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O} + 2\text{HCl} = 4\text{H}_3\text{BO}_3 + 2\text{NaCl} + 5\text{H}_2\text{O}$ ; yield 5–6 parts. Sulphuric acid may be used for hydrochloric, but adheres more persistently to the boric acid, necessitating two or three recrystallizations. It occurs in transparent, colorless, pearly scales or crystals, or fine powder unctuous to the touch, odorless, bitter, permanent, soluble in 18 parts water, 15.3 alcohol, 4.6 glycerin; contains 99.8 p. c. of pure acid. **Tests:** 1. Solution in alcohol or glycerin gives greenish flame. 2. Aqueous solution turns blue litmus paper red, and yellow turmeric paper brownish-red. **Assay:** 1 Gm. dissolved in 50 Cc. distilled water, + 50 Cc. glycerin, should require 16.2 Cc. normal sodium hydroxide V. S., for neutralization (corresponding to at least 99.8 p. c. of acid), using phenolphthalein T. S. indicator. **Impurities:** Heavy metals, iron, arsenic, calcium, magnesium, chlorides, sulphates. Dose, gr. 5–30 (.3–2 Gm.).

PREPARATIONS.—1. *Glyceritum Boroglycerini*. Glycerite of Boroglycerin. (Syn., Glycerite of Glyceryl Borate, Solution of Boroglyceride; Br. Glycerinum Acidi Borici; Fr. Glycéré (Soluté) de Boroglyceride; Ger. Boroglyceridlösung.)

*Manufacture*: Heat glycerin 46 Gm. to 150° C. (302° F.), add boric acid 31 Gm. in portions, constantly stirring, continue heat with frequent stirring until reduced to 50 Gm., add glycerin 50 Gm.—antiseptic.

2. *Unguentum Acidi Borici*. Ointment of Boric Acid.—(Syn., Fr. Onguent d'Acide borique; Ger. Borsalbe.)

*Manufacture*: Melt paraffin 10 Gm., add white petrolatum 80, heat 10 minutes, gradually add hot liquid to boric acid 10, in warm mortar, stir until it congeals.

3. *Cataplasma Kaolini*, 4.5 p. c. 4. *Liquor Antisepticus*, 2 p. c.

*Unoff. Preps.*: *Solutions*, 1–5 p. c.

PROPERTIES.—Antiseptic, poisonous.

USES.—Dyspepsia, restores acidity to ammoniacal urine; externally—conjunctivitis, aphthous ulcers of mouth, diphtheria, vaginitis, otorrhœa, pharyngitis, burns, ulcers, boils, pruritus, urticaria, eczema, psoriasis, catarrhs, cystitis, gonorrhœa, erysipelas, tinea, fetid feet. Trituration with ether facilitates its powdering.

## SULPHUR.

S<sup>n</sup> = 32.

The element sulphur (AS. *swefel*, fr. Skt. *culva*, copper, + *ari*, enemy to, or L. *sal*, salt, + Gr. *πῦρ*, fire, its combustible quality—brimstone, has same meaning, brynstone, burnstone) is found free in volcanic districts, as of Sicily, and universally in combination as sulphates, sulphides, etc. We have several official forms.

**Sulphur Sublimatum. Sublimed Sulphur.**—(Syn., Flores Sulphuris, Flowers of Sulphur, Brimstone; Fr. Soufre (sublimé), Fleurs (Crème) de Soufre; Ger. Schwefel (blumen), Schwefelblüthe.)

*Manufacture*: It is prepared by subliming the crude sulphur and passing the vapors into large condensing chambers, thus leaving behind all earthly impurities save arsenic, which, when present, passes over as arsenic sulphide, also by oxidization during sublimation may have formed sulphurous and sulphuric acids, all of which must be removed. It is a fine, yellow powder, slight characteristic odor, faintly acid taste, insoluble in water, soluble in carbon disulphide, slightly in alcohol, more readily in petroleum benzin, benzene, ether, chloroform, boiling solutions alkali hydroxides, oil of turpentine, etc., fuses at 115° C. (239° F.) to yellow, mobile liquid, in air burns to SO<sub>2</sub>, recognized by odor and by blackening paper moistened with mercurous nitrate T. S.; contains 99 p. c. of pure sulphur, residue 0.5 p. c. Dose, gr. 10–60 (.6–4 Gm.).

PREPARATIONS.—1. *Sulphur Lotum*. Washed Sulphur. (Syn., Fr.

Soufre lavé; Ger. Sulfur depuratum, Gereinigter Schwefel (blumen), Flores Sulfuris Loti.)

*Manufacture*: Digest for 3 days sublimed sulphur 100 Gm., ammonia water 10 Cc., water 200 Cc., strain, wash sulphur well, then dry. This removes acid (sulphuric) impurities and arsenic— $\text{H}_2\text{SO}_4 + \text{As}_2\text{S}_3 + 8\text{NH}_4\text{OH} = (\text{NH}_4)_2\text{SO}_4 + (\text{NH}_4)_3\text{AsO}_3 + (\text{NH}_4)_3\text{AsS}_3 + 5\text{H}_2\text{O}$ . It is a fine yellow powder, odorless, tasteless, solubility similar to sublimed sulphur; contains 99.5 p. c. of pure sulphur; residue 0.2 p. c. *Impurities*: Arsenic, metallic and earthy substances, acid, ammonia. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.).

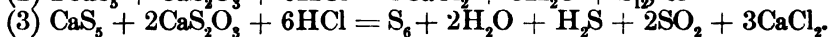
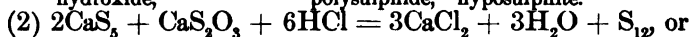
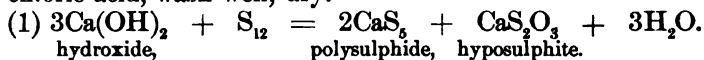
*Preps.*: 1. *Unguentum Sulphuris*. Sulphur Ointment. (Syn., Fr. Pomade soufrée, Pomatum Sulfuratum; Ger. Unguentum Sulfuratum simplex, Schwefelsalbe.)

*Manufacture*: 15 p. c. Rub washed sulphur 15 Gm. with benzoated lard 85 Gm. gradually added, mix thoroughly. Used externally.

2. *Pulvis Glycyrrhizæ Compositus*, 8 p. c.

2. *Sulphur Præcipitatum*. Precipitated Sulphur. (Syn., Lac Sulphuris, Milk of Sulphur, Magisterium Sulphuris; Fr. Soufre précipité, Magistère (Lait) de Soufre; Ger. Schwefelmilch.)

*Manufacture*: Boil 1 hour sublimed sulphur 100 Gm., lime 50, water 1,500 Cc., decant, filter, precipitate filtrate with diluted hydrochloric acid, wash well, dry.



This is divided more finely than sublimed sulphur, consequently is a fine, amorphous powder, pale yellow color, odorless, tasteless, solubility similar to sublimed sulphur; contains 99.5 p. c. of pure sulphur, no residue. *Impurities*: Arsenic, acid, alkali. Dose, gr. 10–60 (.6–4 Gm.).

*Unoff. Preps.*: *Confectio Sulphuris* (Br.), 45 p. c., dose, ʒj–2 (4–8 Gm.). *Trochiscus Sulphuris* (Br.), each contains precipitated sulphur gr. 5 (.3 Gm.). *Ointment*.

**PROPERTIES.**—Alterative, laxative, diaphoretic, resolvent, antiparasitic, stimulant. Much of it passes out of the system unchanged, a small part is converted into sulphides and hydrogen sulphide, this latter being excreted by the breath and skin, gives patients a disagreeable odor, and blackens all silver wearing effects; it increases peristalsis, making movements softer and more frequent. Sulphides after entering the blood are excreted in the urine as sulphates.

**USES.**—Constipation, hemorrhoids, pregnancy, anal fissure, stricture or prolapsus, lead-poisoning, chronic rheumatism, gout, bronchitis, asthma. Externally—scabies, diphtheria, sciatica, psoriasis, eczema, acne, sycosis, croup. The *washed* and *precipitated* forms are preferable for internal use, as they contain no arsenic; the latter is best for ointment, owing to its finer division.

**Sulphuris Iodidum.** Sulphur Iodide,  $S_2I_2$ .—(Syn., Sulfur Iodatum, Ioduretum Sulfuris; Fr. Iodure de Soufre; Ger. Jodschwefel.)

*Manufacture:* Triturate thoroughly together washed sulphur 20 Gm., iodine 80 Gm.; heat mixture on water-bath at  $60^\circ$  C. ( $140^\circ$  F.) until combined (uniform dark color), then increase heat until fused, pour upon cold surface; keep cool in well-stoppered bottles. This is considered a subiodide (disulphide); occurs in brittle masses, crystalline fracture, grayish-black, metallic lustre, iodine odor, acrid taste, insoluble in water, soluble in 60 parts glycerin; alcohol, ether, or solution potassium iodide dissolves out the iodine, moderate heat dissipates it, high heat leaves slight residue. *Assay:* 0.5 Gm. + 1 Gm. potassium iodide dissolved in water 20 Cc. (sulphur separating), requires 28 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. for decolorization, using starch T. S. indicator.

**PREPARATION.**—(Unoff.) *Unguentum Sulphuris Iodidi* (Br.), 4 p. c.

**PROPERTIES AND USES.**—Stimulant, caustic; substitute for iodine, acne, eczema, tinea capitis, lupus, lepra.

**Acidum Sulphuricum.** Sulphuric Acid,  $H_2SO_4$ .—(Syn., Oil of Vitriol, Vitriolic Acid; Fr. Acide sulfurique, Huile de Vitriol; Ger. Vitriölöl, Schwefelsäure.) A liquid composed of not less than 92.5 p. c., by weight, of absolute sulphuric acid ( $H_2SO_4$ ), and about 7.5 p. c. of water.

*Manufacture:* It is made by burning sulphur or pyrites, and oxidizing the  $SO_2$  thus obtained by  $HNO_3$ , then passing this sulphuric oxide into steam, whereby sulphuric acid condenses in leaden chambers arranged for the purpose; from these it is drawn off and evaporated to the proper strength. In actual practice the  $SO_2$  is passed over fumes of  $NO_2$  arising from the decomposition of  $KNO_3$  or  $NaNO_3 + H_2SO_4$  in the presence of an abundant supply of air. The sulphurous oxide,  $SO_2$ , will not take up O to become sulphuric oxide,  $SO_3$ , from the air alone, hence this indirect method has to be used; the nitric acid is deoxidized into nitric oxide, and this unites with O of air to form nitric peroxide, while this again supplies fresh O to the sulphurous acid:

(1)  $S_2 + O_2 = 2SO_2$ . (2)  $SO_2 + H_2O = H_2SO_3$ . (3)  $2NO + O_2 = 2NO_2$ . (4)  $H_2SO_3 + NO_2 = H_2SO_4 + NO$ . (5)  $3H_2SO_3 + 2HNO_3 = 3H_2SO_4 + H_2O + 2NO$ . (6)  $SO_2 + O + H_2O = H_2SO_4$ .

In this process five things are evidently necessary: sulphur, nitre ( $HNO_3$ ), air, watery vapor, heat. It is a colorless, oily, inodorous, corrosive liquid, sp. gr. 1.826, miscible with water or alcohol with evolution of heat, boils at  $338^\circ$  C. ( $640^\circ$  F.), volatile. *Tests:* 1. Chars cane-sugar or wood. 2. Barium chloride T. S. gives white precipitate, insoluble in hydrochloric acid. *Assay:* Weigh accurately 3 Cc., dilute with 50 Cc. distilled water, titrate with normal potassium hydroxide V. S., using methyl-orange T. S. indicator, multiply number Cc. of V. S. consumed by 4.8675, divide product by weight of acid taken, quotient = p. c. of absolute acid. *Impurities:* Heavy metals, lead arsenic, selenium, hydrochloric, sulphurous, nitrous and nitric acids, non-volatile substances. Should be kept in glass-stoppered bottles. Dose, Mij-5 (.13-.3 Cc.), well diluted.



PREPARATIONS.—1. *Acidum Sulphuricum Dilutum*. Diluted Sulphuric Acid. (Syn., Fr. Acide sulfurique dilué; Ger. Verdünnte Schwefelsäure.)

*Manufacture*: Add gradually, constantly stirring, sulphuric acid 100 Gm. to distilled water 825 Gm.; contains 10 p. c., by weight, of absolute sulphuric acid; sp. gr. 1.067. *Assay*: To neutralize 4.868 Gm. should require 10 Cc. normal potassium hydroxide V. S. (each Cc. of V. S. corresponding to 1 p. c. of absolute acid), using methyl-orange T. S. indicator. *Tests and Impurities*: Same as for strong acid. Dose,  $\mathfrak{M}\nu$ -30 (.3-2 Cc.), well diluted.

2. *Acidum Sulphuricum Aromaticum*. Aromatic Sulphuric Acid. (Syn., Elixir of Vitriol, Tinctura Aromatica Acida; Fr. Elixir vitriolique, Teinture (alcoolé) aromatique sulfurique; Ger. Elixir Vitrioli Mynsichti, Saure Aromatischetinktur, Mynsicht's Elixir.)

*Manufacture*: Add gradually sulphuric acid 11 Cc. to alcohol 70 Cc., cool, add tincture of ginger 5 Cc., oil of cinnamon 0.1 Cc., alcohol q. s. 100 Cc.; contains about 20 p. c., by weight, of absolute sulphuric acid, partly in form of ethyl sulphuric acid; sp. gr. 0.933. *Assay*: 10 Gm. + 30 Cc. water, boiled several minutes, cooled, diluted with water q. s. 100 Cc., of this 48.68 Cc. + 25 Cc. normal potassium hydroxide V. S., should require 5 Cc. normal sulphuric acid V. S. for neutralization (each Cc. of potassium hydroxide V. S. consumed corresponding to 1 p. c. of absolute acid), using methyl-orange T. S. indicator. Should be kept in glass-stoppered bottles. Dose,  $\mathfrak{M}\nu$ -20 (.3-1.3 Cc.), well diluted.

Prep.: 1. *Syrupus Rosæ*, 1 p. c.

PROPERTIES.—Powerful escharotic, charring black and destroying the parts touched, by abstracting water in the tissues and combining with the albumin; it promotes alkaline secretions, tonic, astringent, poisonous.

USES.—Diarrhœa, hemorrhages, night-sweats, mucous discharges, cholera, quench thirst in fevers, cholera morbus, lead colic, gravel, stone, tape-worms, gastric disorders. Externally—ulcers, gangrene, cancer, caries of bone, ringworm, scabies (ointment 1 part to 8).

*Poisoning*: Similar to nitric acid. Give chalk, magnesium oxide or carbonate, alkaline carbonates, demulcent drinks, oils, egg-white, opium for pain, brandy or whisky for collapse; avoid pump.

*Acidum Sulphurosum*. Sulphurous Acid,  $\text{H}_2\text{SO}_3$ .—(Syn., Sulphurous Anhydride, Sulphur Dioxide; Fr. Acide sulfureux; Ger. Schwefligesäure.) An aqueous solution containing 6.4 p. c., by weight, of sulphur dioxide ( $\text{SO}_2$ ) and about 94 p. c. of water.

*Manufacture*: Heat in a glass flask sulphuric acid 60 Cc. + charcoal 20 Gm., passing the evolved gas through a wash-bottle containing water 50 Cc., thence into well-cooled distilled water 500 Cc. contained in a bottle of 1,000 Cc. capacity, assay small portion, add to remainder sufficient distilled water to give 6.4 p. c., by weight, of sulphur

dioxide. The charcoal acts as a reducing agent upon sulphuric acid— $C + 2H_2SO_4 = CO + 2SO_2 + 2H_2O$ . Sulphurous acid,  $H_2SO_3$ , does not exist in the free state, but undoubtedly is present in solution when  $SO_2$  is passed into water. It is a colorless liquid, characteristic odor of burning sulphur, acid sulphurous taste, sp. gr. 1.028, volatile. *Test*: 1. When heated the evolved gas blackens paper moistened with mercurous nitrate T. S., but will not affect one moistened with lead acetate T. S. *Assay*: Weigh accurately 2 Cc., add 50 Cc. iodine V. S., let stand five minutes, add slowly  $\frac{N}{10}$  sodium thiosulphate V. S. until mixture decolorized, subtract number Cc. of latter V. S. from former V. S., multiply difference by 0.318, divide product by weight of acid taken, quotient = p. c. of absolute acid; dilute with distilled water to obtain 6.4 p. c. of  $SO_2$ . *Impurities*: Sulphuric acid, metals, deficient sulphur dioxide. Dose, 3ss–2 (2–8 Cc.), diluted with water; may be applied externally diluted with water, glycerin, or fat. Should be kept cool, dark, in completely filled, glass-stoppered, dark amber-colored bottles; owing to rapid deterioration should be assayed frequently, and not dispensed unless full strength.

The acid in contact with air is oxidized to sulphuric acid of about the same strength (6.4 p. c.), and exposed to light acquires the property of precipitating the silver sulphide from the nitrate.

**PROPERTIES.**—Antiseptic, germicide, parasiticide, deoxidizing agent, disinfectant, destructive to plant-life, deodorizer (from its great affinity for oxygen, abstracting it from organic bodies), irritant (from  $SO_2$ ); arrests fermentation, putrefaction by destroying the germs—1 p. c. solution by volume killing most micro-organisms.

**USES.**—Throat affections locally as a spray, mop, diphtheria, chronic bronchitis, stomatitis, aphthæ, tonsillar ulcers, syphilitic and tuberculous laryngitis, wounds, scabies, thrush, whooping-cough. Internally—urticaria, fermentative dyspepsia, flatulence, vomiting, especially when vomit frothy and yeasty.

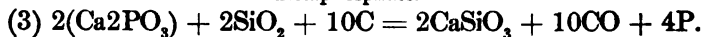
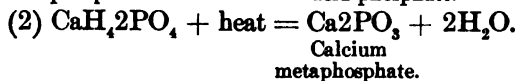
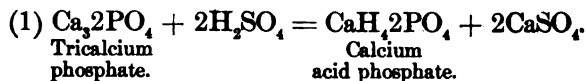
## PHOSPHORUS. PHOSPHORUS.

$P^{III} = 31$ .

(Syn., Fr. Phosphore; Ger. Phosphor.)

The element phosphorus (Gr.  $\varphi\tilde{\omega}\varsigma$ , light, +  $\varphi\acute{\epsilon}\rho\epsilon\upsilon\nu$ , to bring—i. e., emits light in the dark) is official, and occurs in nature combined with various metals (Ca, Fe, Al, etc.), as phosphates, also in plants and animals, constituting about 60 p. c. of all bones in the form of tricalcium phosphate.

*Manufacture*: This is obtained by treating ground bones with  $H_2SO_4$ , when calcium sulphate is precipitated and calcium acid phosphate remains in solution. The latter is evaporated and distilled with sand and charcoal, thereby removing the oxygen and allowing the vaporized phosphorus to distil over, when it is condensed under water.



It is a transparent, nearly colorless solid, waxy lustre, consistence of beeswax, by keeping surface becomes white, red, or black, distinctive, disagreeable odor and taste (use for this only very diluted solutions), on exposure emits white fumes, which are luminous in the dark with garlicky odor, on long exposure often takes fire spontaneously, sp. gr. 1.820, melts at 44° C. (111° F.), soluble in carbon disulphide, 350 parts absolute alcohol, 80 absolute ether, 50 fatty oils, 25 chloroform; contains 99.5 p. c. of pure phosphorus. *Impurities*: Arsenic, sulphur (both due to sulphuric acid used). Should be kept carefully under water, cool, dark, in strong, well-closed vessels. Dose, gr.  $\frac{1}{100}$ – $\frac{1}{30}$  (.0006–.002 Gm.).

**PREPARATIONS.**—1. *Pilulæ Phosphori*. Pills of Phosphorus. (Syn., Fr. *Pilules au Phosphore*, *Pilules phosphorées*; Ger. *Phosphorpillen*.)

*Manufacture*: Dissolve phosphorus .06 Gm. in chloroform 5 Cc., gently heating, replacing from time to time that which evaporates, add this to althæa 6 Gm. + acacia 3, previously mixed, add mixture of glycerin 2 vols. + water 1, q. s. (4 Cc.) for mass, divide into 100 pills; dissolve balsam of tolu 10 Gm. in ether 15 Cc., in this shake pills until coated, roll on plate until dry; each pill contains  $\frac{1}{100}$  gr. (.0006 Gm.). Should be kept in well-stoppered bottles. Dose, 1–5 pills.

*Unoff. Preps.*: *Oleum Phosphoratum*, 1 p. c., + expressed oil of almond 90, ether 10, dose, Mj–5 (.06–.3 Cc.). *Spirit*,  $\frac{1}{4}$  p. c. (alcohol), dose, Mviii–40 (.5–2.6 Cc.). *Elixir* (spirit of phosphorus 21 p. c.), dose, 3ss–2 (2–8 Cc.).

**PROPERTIES.**—Stimulant, tonic, nervine, diaphoretic, irritant, poisonous, nauseant, thickens and renders bones more dense, diminishes tissue-waste. A portion is oxidized into phosphoric acid, and as such enters the blood, some is dissolved by fats and oils that may happen in the stomach, thus being absorbed as phosphorus.

**USES.**—Sexual exhaustion, cerebral softening, mania, melancholia, nerve-debility from overwork, worry, typhoid conditions, scarlet fever, measles, chronic eczema, psoriasis, neuralgia, angina pectoris, aphrodisiac, locomotor ataxia.

*Poisoning*: Have intense intestinal irritation, vomiting, purging, skin cold, pulse feeble, rapid, syncope, death from exhaustion. Empty stomach, give hydrated magnesia, lime water, charcoal, copper sulphate, potassium permanganate, opium, and old (acid) oil of turpentine, this latter being its best antidote. No oils or fat should be used, as they dissolve the phosphorus, thus promoting its absorption. It is eliminated mostly by the urine as orthophosphoric acid, increasing excretion of urinary phosphates, hence evacuate bladder frequently.

*Synergists*: Restoratives, cod-liver oil, arsenic, sulphur.

**Acidum Phosphoricum.** Phosphoric Acid,  $H_3PO_4$ .—(Syn., Br. Acidum Phosphoricum Concentratum (66.3 p. c.); Fr. Acide phosphorique; Ger. Phosphorsäure.) A liquid composed of 85 p. c., by weight, of absolute orthophosphoric acid ( $H_3PO_4$ ) and 15 p. c. of water.

*Manufacture*: It is made by oxidizing phosphorus with diluted nitric acid; the two are heated together in a retort until nitrous fumes cease to be given off, and then concentrated or diluted to desired strength— $5HNO_3 + P_4 + 2H_2O = 3H_3PO_4 + 5NO$ ; 1 part phosphorus requires 3 parts strong nitric acid, which must be diluted in the process and added gradually, that coming over even being returned to the retort; the final evaporation is in a porcelain dish at  $190^\circ C.$  ( $374^\circ F.$ ), to drive out nitric acid; should a portion upon dilution remove within a minute the color of potassium permanganate, the product must be heated with additional nitric acid, to reduce phosphorous acid. It is a colorless, odorless, syrupy liquid, acid taste, sp. gr. 1.707, miscible with water or alcohol, when heated loses water, at  $200^\circ C.$  ( $392^\circ F.$ ) begins to change to pyrophosphoric acid; at higher temperature is converted into metaphosphoric acid, which volatilizes in dense fumes, or forms on cooling a transparent mass of glacial phosphoric acid. *Tests*: 1. Solution ammonium molybdate in dilute nitric acid, gently heated, gives yellow precipitate, soluble in ammonia water; does not act on animal and vegetable matter like mineral acids. *Assay*: 10 Gm. + distilled water q. s. 100 Cc., of this 9.73 Cc. + 10 Cc. cold saturated solution potassium chloride, should require 17 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. of V. S. corresponding to 5 p. c. of absolute acid), using phenolphthalein T. S. indicator. *Impurities*: Heavy metals, arsenic, phosphates, metaphosphoric, pyrophosphoric, hydrochloric, nitric, phosphoric and phosphorous acids. Should be kept in glass-stoppered bottles. Dose,  $\mathfrak{Mj}$ –5 (.13–.3 Cc.), well diluted.

*PREPARATION*.—1. *Acidum Phosphoricum Dilutum*. Diluted Phosphoric acid. (Syn., Fr. Acide phosphorique médicinal; Ger. Verdünnte Phosphorsäure.)

*Manufacture*: Mix phosphoric acid 10 Gm., distilled water 75 Gm.; contains 10 p. c., by weight, of absolute orthophosphoric acid, sp. gr. 1.057. *Assay*: 4.87 Gm. + 5 Cc. cold saturated solution sodium chloride, should require 10 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. of V. S. corresponding to 1 p. c. of absolute acid), using phenolphthalein T. S. indicator. *Tests and Impurities*: Same as for strong acid. Dose,  $\mathfrak{Mv}$ –30 (.3–2 Cc.), well diluted.

Phosphoric acid when heated above  $300^\circ C.$  ( $572^\circ F.$ ) parts with its water, becoming glacial phosphoric acid (*Acidum Metaphosphoricum*)— $H_3PO_4 + \text{heat} = HPO_3 + H_2O$ , which occurs in sticks or glassy lumps, hygroscopic; contains sodium metaphosphate and pyrophosphoric acid, readily soluble in water, gradually changing into phosphoric acid, coagulates egg-albumin.

*PROPERTIES*.—Tonic, alterative, refrigerant.

USES.—Dyspepsia, hysteria, diabetes, leucorrhœa, low fevers, scrofula, caries of bone, night-sweats, catarrhal affections, jaundice, melan-  
cholia, injection for sinuses, scrofulous joints, wash for ulcers.

**Acidum Hypophosphorosum.** Hypophosphorous Acid,  $\text{HH}_2\text{PO}_2$ .—(Syn., Fr. Acide Hypophosphoreux ; Ger. Unterphosphorigesäure.) A liquid composed of 30 p. c., by weight, of absolute hypophosphorous acid,  $\text{HH}_2\text{PO}_2$ , and 70 p. c. of water.

**Manufacture:** Dissolve calcium hypophosphite 138 Gm. in boiling water 900 Cc., add oxalic acid 103 Gm. dissolved in boiling water 400 Cc.; boil mixture, evaporate filtrate to 358 Gm.— $\text{Ca}(\text{PH}_2\text{O}_2)_2 + \text{H}_2\text{C}_2\text{O}_4 = 2\text{HH}_2\text{PO}_2 + \text{CaC}_2\text{O}_4$ ; a weaker acid may be obtained by dissolving potassium hypophosphite 208 parts in 588 water, tartaric acid 300 in diluted alcohol 600, mix, cool, filter— $\text{KH}_2\text{PO}_2 + \text{H}_2\text{C}_4\text{H}_4\text{O}_6 = \text{HH}_2\text{PO}_2 + \text{KHC}_4\text{H}_4\text{O}_6$ . It is a colorless, odorless, acid liquid, sp. gr. 1.130, miscible with water, at  $140^\circ \text{C}$ . ( $284^\circ \text{F}$ .) decomposes into hydrogen phosphide, which ignites, and phosphorous acid. **Tests:** 1. Silver nitrate T. S., diluted with equal volume water, produces black precipitate of metallic silver; mercuric chloride T. S. a white precipitate of mercurous chloride. **Assay:** 10 Gm. + distilled water q. s. 100 Cc., of this 65.5 Cc. should require 30 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. of V. S. corresponding to 1 p. c. of absolute acid), using methyl-orange T. S. indicator. **Impurities:** Heavy metals, arsenic, barium, potassium, phosphoric, phosphorous, sulphuric, oxalic and tartaric acids. Dose,  $\text{Mij}$ –20 (.2–1.3 Cc.).

**PREPARATIONS.**—1. *Acidum Hypophosphorosum Dilutum.* Diluted Hypophosphorous Acid,  $\text{HH}_2\text{PO}_2$ . (Syn., Acid Hypophosphoreux dilué; Ger. Verdünnte Unterphosphorigesäure)

**Manufacture:** Mix hypophosphorous acid 200 Gm., distilled water 400 Gm.; contains 10 p. c., by weight, of absolute acid, sp. gr. 1.042. **Assay:** Same as for strong acid, except only 10 Cc. of V. S. are required for neutralization. **Tests and Impurities:** Same as for strong acid. Should be kept in well-stoppered bottles. Dose,  $\text{Mx}$ –60 (.6–4 Cc.).

**Preps.:** 1. *Syrupus Ferri Iodidi*, 2 p. c. 2. *Syrupus Hypophosphitum*,  $\frac{1}{2}$  p. c. 3. *Syrupus Hypophosphitum Compositus*, 1.5 p. c.

**PROPERTIES AND USES.**—Tonic, mostly in combination with strychnine, quinine, iron; nervous debility. In pharmacy as a reducing agent in analysis, and as a preservative to prevent decomposition of iodides in solution when exposed to light and air. A 50 p. c. acid is also made by evaporating carefully the 30 p. c. acid to three-fifths of its weight, or the 10 p. c. acid to one-fifth of its weight, sp. gr. 1.406.

**Halogens or Haloids.**—Chlorine, Bromine, Iodine, Fluorine. This group of four elements is one of very great importance in medicine and pharmacy. The word halogen is from Gr.  $\delta\alpha\lambda\epsilon\gamma$ , the sea, in reference to their original source; thus chlorine is from sea-salt, bromine from sea-water, and iodine from seaweed; besides this they all have atomic weights of a common ratio—chlorine, 35.4; bromine,

79.8; iodine, 126.6; fluorine, 19, which compared with the last is as 1, 7, 4, 2, or  $35.4 + 126.6 \div 2$  gives 81, which is approximately the atomic weight of bromine. In addition, they possess strong chemical affinities and enter into the composition of a large number of useful compounds.

## CHLORINE.

$$\text{Cl} = 35.4.$$

The element chlorine (Gr. *χλωρόν*, light green—*i. e.*, color of the gas) is a greenish-yellow irrespirable gas, and as such is mainly useful as a reagent in the laboratory and for bleaching, deodorizing, or disinfecting. It is not official, but many of its compounds are.

**Liquor Chlorig Compositus.** Compound Solution of Chlorine, Chlorine Water.—(Syn., Aqua Chlorig, U. S. P. 1890; Fr. Soluté de Chlore composé; Ger. Zusammengesetzte Chlorlösung.) An aqueous solution containing when freshly prepared 0.4 p. c. of chlorine, with some oxides of chlorine, and potassium chloride.

**Manufacture:** Add hydrochloric acid 1.8 Cc., diluted with distilled water 2 Cc., to potassium chlorate 0.5 Gm. in a 200 Cc. flask, placing this in boiling water 2–3 minutes; when flask filled with greenish-yellow gas remove from hot water, and add through funnel, fitting in stopper of flask and containing purified cotton 1 Gm., cold distilled water in two portions of 50 Cc. each; after each portion stopper flask, invert, agitate— $2\text{KClO}_3 + 4\text{HCl} = 2\text{KCl} + 2\text{H}_2\text{O} + 2\text{ClO}_2 + \text{Cl}_2$ . Should be freshly made when wanted. Dose, 3ss–1 (2–4 Cc.).

**PROPERTIES.**—Stimulant, antiseptic, disinfectant, irritant.

**USES.**—Typhus fever, liver affections, blood-poisoning, scarlatina, fetid bronchitis, malignant sore throat, diphtheria, typhoid diarrhoea, dysentery, smallpox, phthisis. Externally—well diluted as a gargle in smallpox, scarlet fever, putrid sore throat, as a wash for ulcers, cancers, buboes, abscesses, itching in skin diseases; chronic catarrh, applied best by atomizer (3ss; 2 Cc. + hot water 3j; 30 Cc.).

**Poisoning:** When inhaled, may have laryngeal irritation, œdema, asphyxia, black eschars, cough, sensation of constriction across chest, difficult deglutition; when swallowed, have burning sensation, possibly perforations of œsophagus and stomach. Inhale ammonia vapor, steam, fresh air, ether, chloroform; emetic, warm water, albumin, white of egg, milk, flour, lime water, stimulants, opium.

**Incompatibles:** Salts of lead and silver.

**Acidum Hydrochloricum.** Hydrochloric Acid, HCl.—(Syn., Muriatic Acid, Spirit of (Sea) Salt, Marine Acid, Acidum Chlorhydricum, Chlorhydric Acid; Fr. Acide hydrochlorique—chlorhydrique—muriatique; Ger. Salzsäure, Chlorwasserstoffsäure.) A liquid composed of 31.9 p. c., by weight, of absolute hydrochloric acid (HCl) and 68.1 p. c. of water.

**Manufacture:** Heat sodium chloride with sulphuric acid, wash

evolved HCl gas and pass it into cold water—(1)  $2\text{NaCl} + \text{H}_2\text{SO}_4 = 2\text{HCl} + \text{Na}_2\text{SO}_4$ . (2)  $\text{NaCl} + \text{H}_2\text{SO}_4 = \text{HCl} + \text{NaHSO}_4$ . The latter equation is used mostly, as less heat is required and the more soluble sulphate formed is easily washed out from the retorts with a stream of water. Much crude acid is produced in the Lablanc soda factories, where sodium chloride and sulphuric acid are heated in cylinders to obtain sodium sulphate (salt-cake), the first step in making sodium carbonate. It is a colorless, fuming liquid, pungent odor, intensely acid taste, fumes and odor disappearing when diluted with 2 volumes of water, sp. gr. 1.158, miscible with water or alcohol. *Tests*: 1. Heated with manganese dioxide evolves chlorine. 2. Silver nitrate T. S. gives white curdy precipitate, insoluble in nitric acid, soluble in ammonia water. *Assay*: Weigh accurately 3 Cc., dilute with 50 Cc. distilled water, titrate with normal potassium hydroxide V. S., using methyl-orange T. S. indicator, multiply number Cc. of V. S. consumed by 3.618, divide product by weight of acid taken, quotient = p. c. of absolute acid. *Impurities*: Heavy metals, arsenic, bromine, free chlorine, iodine, sulphates, sulphuric and sulphurous acids, non-volatile substances. Should be kept in glass-stoppered bottles. Dose, Mij-5 (.13-.3 Cc.), well diluted.

Fuming hydrochloric acid contains 38.2 p. c. HCl, is colorless, fumes strongly in the air, sp. gr. 1.195, used chiefly in chemical processes.

**PREPARATIONS.**—1. *Acidum Hydrochloricum Dilutum*. Diluted Hydrochloric Acid. (Syn., Diluted Muriatic Acid; Fr. Acide chlorhydrique dilué; Ger. Verdünnte Salzsäure.)

*Manufacture*: Mix hydrochloric acid 100 Gm., distilled water 219 Gm.; contains 10 p. c. of absolute hydrochloric acid, sp. gr. 1.050. *Tests and Impurities*: Same as for strong acid. *Assay*: 3.62 Gm. + 20 Cc. water, should require 10 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. of V. S. corresponding to 1 p. c. of absolute acid), using methyl-orange T. S. indicator. Should be kept in glass-stoppered bottles. Dose, Mv-30 (.3-2 Cc.), well diluted.

Prep.: 1. *Liquor Acidi Arsenosi*, 5 p. c.

2. *Argenti Nitras Fusus*, 4 p. c.

**PROPERTIES.**—Tonic, refrigerant, antiseptic, irritant, poisonous. Given before meals checks flow of gastric juice, diminishing acidity, but 2-3 hours after food increases the acidity; acts as gastric antiseptic, being in the gastric juice 0.2 p. c., aiding in the conversion of pepsinogen into pepsin, and of proteids into peptones; increases saliva, bile, pancreatic juice, checks fermentation, cleans tongue, allays thirst, combines with albumin or alkaline base of blood, lessening its alkalinity; prolonged use impairs digestion, constipates. The strong applied to the skin produces a blister, destroys tissue, whitens mucous membranes, causing necrosis and sloughing.

**USES.**—Low fevers, phthisis, syphilis, phosphatic deposits, acid dyspepsia, gastro-intestinal indigestion without diarrhoea (after meals), chronic gastric catarrh, gastric cancer, to quench thirst, skin diseases (eczema, psoriasis), diphtheria, stomatitis.

*Poisoning*: Similar to nitric acid. Give alkalies, magnesium oxide, sodium bicarbonate, soap, demulcent drinks, albumin, oil, milk; opium for pain, brandy or whisky for collapse.

*Incompatibles*: Oxidizable substances (explosive), alkalies, carbonates, salts of Ag, Ca, Pb, glucosides.

*Synergists*: Digestive ferments, vegetable bitters, gentian, nuxvomica, etc.

## BROMUM. BROMINE.

$\text{Br}^1 = 79.76.$

(Syn., Brominium; Fr. Brôme; Ger. Brom.)

The element bromine (Gr.  $\beta\rho\omega\mu\omicron\varsigma$ , bad smell, stink—*i. e.*, its disagreeable odor) is official, and while in the free state has some uses, yet in the various combinations with metals to form salts is of far greater service in medicine.

*Manufacture*: It is in seawater  $\frac{1}{175}$  p. c., along with numerous salts; by evaporating the water most of these latter crystallize out, leaving the bromine (bromides to be obtained from the mother-liquor or bittern; now mostly obtained from mother-liquors of salt-works, United States, Germany (Stassfurt), which have been freed by crystallization of chlorides and sulphates, and contain bromine combined with magnesium or calcium—pass chlorine into mother-liquors slightly heated, by which bromides become decomposed— $\text{MgBr}_2 + \text{Cl}_2 = \text{MgCl}_2 + \text{Br}_2$ ; the volatilized bromine is condensed under cold water, that escaping being caught in solution potassium hydroxide for making potassium bromide. It is a heavy, dark brownish-red, mobile liquid, evolving at ordinary temperature reddish fumes, highly irritating to eyes, lungs, with suffocating odor of chlorine, boils at  $63^\circ \text{C}$ . ( $145^\circ \text{F}$ .), sp. gr. 2.995, soluble in alcohol, ether (gradually decomposing them), chloroform, carbon disulphide, 28 parts water, no residue; contains at least 97 p. c. of pure bromine. *Tests*: 1. Destroys color of litmus and indigo solutions, gives yellow to that of starch. 2. With excess potassium hydroxide T. S. get clear liquid, without separation of oily drops (abs. of organic bromine compounds). *Impurities*: Iodine, organic bromine compounds. Should be kept dark, cool, in glass-stoppered bottles.

**PROPERTIES AND USES.**—Powerful corrosive irritant, caustic, deodorant, disinfectant, sedative; used occasionally for glandular enlargements, scrofulous ulcers, tertiary syphilis, bronchocele, chronic skin affections, cardiovascular conditions; locally for gangrene, ulcers, specific for poison-ivy; two-thirds of entire output in preparing the bromides, the rest for aniline dyes.

*Poisoning*: Have burning pain in mouth, œsophagus, abdominal cavity, vomiting, purging, collapse, death, perforation may result. Give ammonia water well diluted, demulcent drinks, external heat, opium, atropine, strychnine.



**Acidum Hydrobromicum Dilutum.** Diluted Hydrobromic Acid.—(Syn., Acidum Bromhydricum (dilutum); Fr. Acide hydrobromique dilué; Ger. Verdünnte Hydrobromsäure, Verdünnte Bromwasserstoffsäure.) A liquid composed of 10 p. c., by weight, of absolute hydrobromic acid, HBr, and about 90 p. c. of water.

**Manufacture:** Pour diluted sulphuric acid into hot saturated solution of potassium bromide, after 24 hours, the potassium sulphate having crystallized out, the liquid is distilled in glass retort— $2\text{KBr} + \text{H}_2\text{SO}_4 = 2\text{HBr} + \text{K}_2\text{SO}_4$ ; or pass  $\text{H}_2\text{S}$  into bromine and water— $10\text{Br} + 2\text{H}_2\text{S} + 4\text{H}_2\text{O} = 10\text{HBr} + \text{H}_2\text{SO}_4 + \text{S}$ ; or by dissolving tartaric acid 10 parts and potassium bromide 8, each in water 25, mix, cool— $\text{KBr} + \text{H}_2\text{C}_4\text{H}_4\text{O}_6 = \text{HBr} + \text{KHC}_4\text{H}_4\text{O}_6$ ; here acid potassium tartrate is formed, which upon standing crystallizes out, leaving a supernatant 15 p. c. solution of hydrobromic acid. It is a clear, colorless, odorless, acid liquid, volatile, sp. gr. 1.076, miscible with water or alcohol; on distilling water and weak acid first pass over, and at  $126^\circ \text{C}$ . ( $259^\circ \text{F}$ .) the strongest solution (acid) obtainable remains, 48 p. c., which may be distilled unchanged; an acid (solution) of 34 p. c. is also manufactured. **Tests:** 1. Silver nitrate T. S. gives yellowish-white precipitate, insoluble in nitric acid, soluble in stronger ammonia water, solutions sodium thiosulphate or potassium cyanide. 2. Copper sulphate T. S. — sulphuric acid gives deep red color. **Assay:** Dilute 10 Gm. with distilled water q. s. 100 Cc., of this 8.04 Cc., neutralized with diluted ammonia water (using litmus T. S. indicator) — 3 drops potassium chromate T. S., should require 10 Cc.  $\frac{N}{10}$  silver nitrate V. S. to impart to liquid a permanent red color (each Cc. of V. S. corresponding to 1 p. c. of absolute acid). **Impurities:** Heavy metals, arsenic, barium, iodine, free bromine, chlorides, hydrochloric and sulphuric acids, non-volatile substances. Should be kept dark, in amber-colored, glass-stoppered bottles. Dose, ʒss–1 (2–4 Cc.), in water or flavored syrup.

**PROPERTIES**—Sedative, narcotic, small doses stimulant.

**USES.**—Very similar to potassium bromide, but does not depress like it. Epilepsy, nervousness, headache, tinnitus aurium, vomiting, whooping-cough, muscular spasms, neuralgia, bronchial coughs, cerebral hyperæmia, insomnia, irritable heart.

Pure hydrobromic acid is a colorless gas, having pungent irritating odor, producing dense white fumes in a damp atmosphere, sp. gr. 2.797; strongest solution obtainable is 47.8 p. c., and one of 34 p. c. is marketed.

## IODUM. IODINE.

$\text{I} = 125.90$

(Syn., Iodinium; Fr. Iode; Ger. Jodum, Jod.)

The element iodine (Gr.  $\text{ἰὼν}$ , violet, +  $\text{εἶδος}$ , form, likeness—i. e., from its violet-colored vapor) is official, and occurs in nature combined with the metals sodium, potassium, magnesium, etc.

*Manufacture:* An important source is the ash (kelp) of seaweeds, which contains about  $\frac{1}{20}$  of its weight of iodine; the weeds are dried, burnt at the lowest possible temperature, ash exhausted with hot water, solution filtered, evaporated, cooled, when the less soluble salts—potassium chloride, sodium carbonate, and sulphate crystallize out; to mother-liquor, containing sodium and magnesium iodides, heated in lead retorts to  $60^{\circ}$  C. ( $140^{\circ}$  F.) manganese dioxide and sulphuric acid are added, when iodine distills over, being collected in glass receivers— $2\text{NaI} + 3\text{H}_2\text{SO}_4 + \text{MnO}_2 = \text{I}_2 + 2\text{NaHSO}_4 + \text{MnSO}_4 + 2\text{H}_2\text{O}$ . Much iodine is now obtained in Chile from the mother-liquor of saltpetre, containing about 22 p. c. of sodium iodate, by treating it with sulphurous acid— $2\text{NaIO}_3 + 5\text{H}_2\text{SO}_3 = \text{Na}_2\text{SO}_4 + 4\text{H}_2\text{SO}_4 + \text{I}_2$ ; the liberated iodine is filtered or distilled off, and may be purified by mixing with potassium iodide and subliming. It is in heavy bluish-black friable rhombic plates, metallic lustre, distinctive odor, sharp, acrid taste, sp. gr. 4.948, imparts deep brown, slowly evanescent stain, and slowly destroys vegetable colors; soluble in ether, chloroform, carbon disulphide, 10 parts alcohol, 5,000 water, volatile with purple vapor; contains 99 p. c. of pure iodine. *Tests:* 1. With starch T. S. gives dark blue color, and dissolved in chloroform should be clear and limpid (abs. of moisture). *Assay:* Add 0.5 Gm. to a weighing bottle, + potassium iodide 1 Gm., dissolve in water 50 Cc., add  $\frac{N}{10}$  sodium thiosulphate V. S. until liquid decolorized, the number Cc. of V. S. consumed multiplied by 1.259, divided by weight of iodine taken = p. c. of iodine present. *Impurities:* Chlorine, bromine, cyanogen, iodine cyanide, water. Should be kept cool, in glass-stoppered bottles. Dose, gr.  $\frac{1}{4}$ –1 (.016–.06 Gm.).

*PREPARATIONS.*—1. *Liquor Iodi Compositus.* Compound Solution of Iodine. (Syn., Lugol's Solution; Br. Liquor Iodi Fortis, Strong Solution of Iodine, Liniment of Iodine, Liquor Iodinii Compositus; Fr. Soluté ioduré de Lugol; Ger. Lugolsche Jodlösung.)

*Manufacture:* 5 p. c. Dissolve iodine 5 Gm., potassium iodide 10 Gm., in distilled water q. s. 100 Gm. This aqueous solution contains 5 p. c. of iodine, and 10 p. c. of potassium iodide, and to decolorize 6.3 Gm. requires 24.75 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. (each Cc. of V. S. corresponding to 0.2 p. c. of iodine). Should be kept in glass-stoppered bottles. Dose, Mj–10 (.06–.6 Cc.); mostly used externally.

2. *Tinctura Iodi.* Tincture of Iodine. (Syn., Tinctura Iodinii; Fr. Teinture d'Iode; Ger. Jodtinktur.)

*Manufacture:* 7 p. c. Triturate rapidly to coarse powder iodine 7 Gm. and potassium iodide 5, to these in a bottle add alcohol q. s. 100 Cc., shake. *Assay:* 5 Cc. + 25 water, titrated with  $\frac{N}{10}$  sodium thiosulphate V. S., should require of latter 27.25 Cc. for complete decolorization (corresponding to 6.86 Gm. iodine in 100 Cc.). Dose, Mj–5 (.06–.3 Cc.); mostly used externally.

3. *Unguentum Iodi.* Iodine Ointment. (Syn., Unguentum Iodinii; Fr. Pommade d'Iode; Ger. Jodsalbe.)

*Manufacture:* 4 p. c. Triturate iodine 4 Gm. and potassium iodide 4,

with glycerin 12, until dissolved, incorporate gradually benzoinated lard 80 Gm., mix avoiding metallic spatula; should be freshly made when required.

*Unoff. Preps.*: *Liquor Iodi Fortis* (Br.), 12 p. c. (+ potassium iodide 7 p. c.). *Churchill's Tincture of Iodine*, 16.5 p. c. (+ potassium iodide 3.3 Gm., water 25, alcohol q. s. 100 Cc.). *Decolorized Tincture of Iodine*, 8.3 p. c. (+ sodium thiosulphate 8.3 Gm., water 10, stronger ammonia water 6.5, alcohol q. s. 100 Cc.).

**PROPERTIES.**—Antiseptic, counter-irritant, causing itching, smarting of the skin, corrosive, alterative, absorbent. Rapidly absorbed by mucous membranes, in the blood combined with sodium; eliminated in urine, saliva, milk, by intestinal and nasal mucous membranes.

**USES.**—Mostly external; enlarged glands, chronic abscesses, swollen joints, chilblains, ringworm, chronic pneumonia, lung affections, boils, carbuncles, suppurating glands, hydrocele, ovarian cyst, hernia, dropsy of the joints, large chronic bronchocele, chronic abscesses, fistulæ, wounds of venomous serpents, bites of rabid animals, hydrocephalus, chronic dysentery, diarrhœa.

**Poisoning**: Have metallic taste, pain in throat and stomach, salivation, intense thirst and gastro-enteritis, vomiting, purging, pale face, suppressed urine, vertigo, faintness, feeble and rapid pulse, fever, cyanosis, swollen eyelids, convulsive movements, collapse. Give emetics, starch, flour, arrowroot mixed with water, induce vomiting, sodium bicarbonate, hypodermic ammonia, stimulants (strychnine, digitalis, alcohol, atropine), morphine, demulcents, heat.

**Incompatibles**: Ammonia, mineral acids, metallic salts, alkaloids, forming insoluble compounds with most of these. Iodides with mineral acids, acid salts, bismuth subnitrate, alkaloids, silver nitrate, soluble lead salts, potassium chlorate, spirit nitrous ether, licorice.

## II. METALS AND THEIR COMPOUNDS (SALTS).

These are treated also in natural groups, which associate those together having the strongest points of relationship. Thus in regular sequence we have:

### LIGHT METALS.

*Alkali Metals.*  
K, Na, Li, (NH<sub>4</sub>).  
Oxides, carbonates, and  
most salts soluble.

*Alkaline Earth Metals.*  
Ba, Ca, Sr, (Mg).  
Oxides soluble,  
carbonates insoluble.

*Earth Metals.*  
Al, and some rare metals.  
Oxides insoluble.

### HEAVY METALS.

*Iron Group.*  
Fe, Mn, Cr, Co, Ni, Zn.  
Sulphides soluble in  
diluted acids.

*Lead Group.*  
Cd, Pb, Cu, Bi, Ag, Hg.

*Arsenic Group.*  
As, Sb, Sn, Au, Pt, Mo.

Sulphides insoluble in diluted acids.

Sulphides insoluble in  
ammonium sulphide.

Sulphides soluble in  
ammonium sulphide.

## POTASSIUM (KALIUM).

K<sup>1</sup> = 39.

Potassium (L. for potash—*pot* + *ash*—i. e., origin of the salts by evaporating wood-ash lye in pots; Ar. *kali*, L. *kalium*, ashes) occurs in nature to a great extent as a double silicate of potassium and aluminum (granitic rocks, feldspar, etc.), also as chloride, nitrate, bitartrate, and carbonate, the latter being the predominant salt in wood-ashes. The metal is obtained by heating this carbonate with carbon in iron retorts, passing the evolved vapors into coal-oil in order to condense the metal— $\text{K}_2\text{CO}_3 + 2\text{C} = 2\text{K} + 3\text{CO}$ . Plants derive much of their potassium from these disintegrated rocks, containing the silicate, which is absorbed by falling rain; this percolates through the soil, and from that the plant-roots (rootlets, trichomes) in turn take it. Potassium occurs also in native wood, chiefly as the acetate, but to some extent as sulphate, chloride, tartrate, citrate, etc., most of which upon incineration become converted into the carbonate.

*Tests for Potassium Salts:* 1. With platinic chloride, alcohol, and HCl, get a yellow crystalline precipitate ( $\text{PtCl}_4 \cdot 2\text{KCl}$ ). 2. With strong solution of tartaric acid, get a white crystalline precipitate of cream of tartar—alcohol facilitates the precipitation. 3. The flame of a Bunsen burner is colored violet, which can be recognized, even though sodium be present, through the intervention of blue glass or indigo solution. 4. Potassium salts are soluble in water, non-volatile, and usually white.

**Potassii Carbonas.** Potassium Carbonate,  $\text{K}_2\text{CO}_3$ .—(Syn., Carbonas Potassicus (Kalicus), Potassii Carbonas Purus, Sal Tartari, Salt of Tartar; Fr. Carbonate de Potasse; Ger. Kalium carbonicum (purum), Kaliumcarbonat, Kohlensaures Kali.)

*Manufacture:* This is obtained by percolating wood-ashes with water, which takes up the potassium carbonate together with a little chloride, sulphate, also the sodium salts, while calcium and magnesium carbonates, phosphates, and sulphates, together with silica, are left behind. This percolate (lye) is evaporated, giving *crude potash* (*Kalium carbonicum crudum*, *Pottasche*, Ger.), which by calcining becomes *pearl-ash*, and this in turn purified yields the official carbonate. It may also be derived from residual ash in beet-sugar manufacture, or washings of sheep-wool, or from the native chloride by Leblanc's process for sodium carbonate, and likewise from the purer bicarbonate by heat— $2\text{KHCO}_3 = \text{K}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ . It is a white granular powder, odorless, alkaline, very deliquescent, soluble in 0.91 part water, insoluble in alcohol, gives violet flame, effervesces with acids; contains 98 p. c. of pure salt. *Assay:* 1 Gm. dissolved in 50 Cc. water should require at least 14.28 Cc. normal sulphuric acid V. S. for neutralization, using methyl-orange T. S. indicator. *Impurities:* Heavy metals, earthy substances, nitrate. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.); locally in solution (2 p. c. + water), or ointment (2–12 p. c. + lard).

**PREPARATIONS.**—1. *Mistura Ferri Composita*,  $\frac{8}{10}$  p. c. 2. *Pilulæ*

*Ferri Carbonatis*,  $1\frac{1}{2}$  gr. (.075 Gm.). 3. *Syrupus Rhei*, 1 p. c. 4. *Syrupus Rhei Aromaticus*,  $\frac{1}{10}$  p. c.

USES.—Chiefly in the preparation of the other potassium salts, also as an antacid in dyspepsia, diuretic in dropsy, antilithic in uric acid gravel, jaundice; externally in cutaneous affections, caustic, irritant poison.

*Poisoning*: Same as for potassium hydroxide. Give antidotes—fixed oils, vegetable acids, lemon-juice, vinegar, demulcents.

*Allied Salt*:

1. *Potassii Carbonas Impura*. *Impure Carbonate of Potassium*.—Official 1830–1860 (pearl-ashes, pearl-ash).

This is simply the crude potash salts, black salts, derived from the evaporated lye of wood-ashes, subjected to direct flame in an oven-shaped furnace. By this means all combustible impurities are burnt out, and the mass, from being black, becomes of a bluish-white color. It is still official in Germany as *Kalium carbonicum crudum*, *Pottasche*.

**Potassii Bicarbonas.** *Potassium Bicarbonate*,  $\text{KHCO}_3$ .—(Syn., Acid Carbonate of Potassium, *Kali Carbonicum Acidulum*, *Bicarbonas Potassicus* (*Kalicus*); Fr. *Bicarbonate de Potasse*; Ger. *Kalium bicarbonicum*, *Kaliumbicarbonat*, *Doppelt-Kohlensaures Kali*.)

*Manufacture*: Pass carbon dioxide through strong solution of potassium carbonate, when the less soluble bicarbonate precipitates— $\text{K}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2 = 2\text{KHCO}_3$ . It is in colorless, transparent, monoclinic, odorless prisms, or granular powder, saline, alkaline taste, permanent, soluble in 3 parts water, almost insoluble in alcohol, at red heat loses 30.96 p. c., residue being carbonate; contains 99 p. c. of pure salt. *Assay*: 1 Gm. should require at least 19.9 Cc.  $\frac{\text{N}}{2}$  sulphuric acid V. S. for neutralization, using methyl-orange T. S. indicator. *Impurities*: Heavy metals, carbonate. Should be kept in well-stoppered bottles. Dose, gr. 5–60 (.3–4 Gm.), well diluted.

PREPARATIONS.—1. *Liquor Potassii Arsenitis*, 2 p. c. (+ arsenous acid 1 p. c.). 2. *Liquor Potassii Citratis*, 8 p. c. of bicarbonate. 3. *Liquor Magnesii Citratis*. 39 gr. (2.5 Gm.) of bicarbonate to each bottle.

USES.—As the purest source of the potassium salts, similar to carbonate, but has milder taste and is more acceptable to the stomach. Used in beverages, laxative draughts, etc.

**Potassii Hydroxidum.** *Potassium Hydroxide*,  $\text{KOH}$ .—(Syn., *Potassa*, U. S. P. 1890, *Potassium Hydrate*, *Caustic Potash*, *Kali Carbonicum Fusum* (*Purum*), *Oxydum Potassicum*, *Lapis Causticus*, *Surrogorum*; Br. *Potassa Caustica*; Fr. *Potasse caustique* (*fondue*), *Pierre à Cautère*; Ger. *Kali causticum fusum*, *Kaliumhydroxyd*, *Aetzkali*.)

*Manufacture*: Evaporate liquor potassii hydroxidi to dryness, then pour into moulds and quickly bottle to prevent deliquescence. It may also be made by action of the metal potassium on water, and evaporating— $\text{K} + \text{H}_2\text{O} = \text{KOH} + \text{H}$ . It is in dry, white flakes, fused

masses, or pencils, hard, brittle, fracture crystalline, odorless, or faint odor of lye, very acrid caustic taste (handle and taste cautiously, as it quickly destroys organic tissue); on exposure rapidly absorbs  $\text{CO}_2$  and moisture (deliquesces), soluble in 0.4 part water, 2 alcohol, slightly in ether; contains 85 p. c. of pure salt, and not more than 2 p. c. of other inorganic substances, with the exception of water. *Assay*: Dissolve 1 Gm. in 50 Cc. water, titrate with normal sulphuric acid V. S., using methyl-orange T.S. indicator; multiply number Cc. of V.S. consumed by 5.574, divide product by weight of potassium hydroxide taken, quotient must be at least 85, which represents p. c. of pure salt (KOH) present. *Impurities*: Heavy metals, carbonate. Should be kept in well-stoppered bottles made of hard glass. Dose, gr. 1–2 (.06–.13 Gm.), well diluted.

**PREPARATIONS.**—1. *Liquor Potassii Hydroxidi*. Solution of Potassium Hydroxide. (Syn., *Liquor Potassæ*, U. S. P. 1890, Solution of Potassium Hydrate, *Kali Hydricum Solutum*, *Lixivium Causticum*; Fr. *Potasse caustique liquide*, *Lessive caustique*; Ger. *Liquor Kali caustici*, *Kalilauge*, *Aetzkallilauge*.)

*Manufacture*: 5 p. c. Dissolve potassium hydroxide 6 Gm. in distilled water q. s. 100 Gm.; contains 5 p. c. of pure salt. It is a clear, colorless, aqueous liquid, odorless, very acrid, caustic taste, strongly alkaline reaction, sp. gr. 1.046. *Assay*: To neutralize 28 Gm. requires 25 Cc. normal sulphuric acid V. S., methyl-orange T. S. indicator (each Cc. of V. S. indicating 0.2 p. c. of absolute salt). Should be kept in green-glass bottles, with glass stoppers coated with paraffin or petrolatum. Dose,  $\text{Mv}$ –30 (.3–2 Cc.), well diluted.

Prep.: 1. *Fluidextractum Senegæ*, 3 p. c.

2. *Liquor Cresolis Compositus*, 8 p. c.

*Unoff. Prep.*: *Potassa with Lime*, each 50 p. c.; used externally.

**PROPERTIES.**—Potassium hydroxide is one of our strongest caustics or escharotics; destroys tissues by abstracting moisture and dissolving albumin, fibrin, and gelatin. Its action differs from that of silver nitrate in not being superficial, but in penetrating deeply.

Internally—before meals stimulates acid secretions, at the end or after meals neutralizes gastric juice already secreted; renders blood alkaline in which it circulates (possibly as carbonates); renders urine alkaline, increasing its power of holding uric acid in solution; promotes waste, bronchial secretions, checks saliva.

**USES.**—To cauterize chancres, poisoned wounds, ingrown nails, scrofulous abscesses, carbuncles, tumors, varicose veins, diphtheria, urethral stricture, corns. Internally, as an antacid in acid dyspepsia, calculous disorders. Liquor—used similarly, but owing to less strength has a much milder action; potassa with lime—acts more strongly and is less deliquescent than the pure salt.

*Poisoning*: Similar to ammonia. Have sensation of heat in throat, vomiting, diarrhoea, abdominal pain, feeble, quick pulse, clammy skin, tongue, lips, and throat swollen, soft, red. Give emetics, or wash out

stomach, weak acids, lemon-juice, vinegar, demulcents, oils, flaxseed tea, egg-white.

*Incompatibles:* Acids, acid salts, metallic salts, preparations of ammonia, belladonna, hyoscyamus, scopolia, and stramonium (alkaloids being decomposed, and all alkaloids being precipitated by alkalies).

*Allied Product:*

1. *Potassa Sulphurata. Sulphurated Potassa.*—Obtained by mixing sublimed sulphur 100 Gm. with dried potassium carbonate 200 Gm., heating until fused, pouring on a cold marble slab— $3K_2CO_3 + S_8 = 2K_2S_3 + K_2S_2O_3 + 3CO_2$ . It is not a definite chemical compound, being a mixture of sulphide ( $K_2S_3$ ) and thiosulphate ( $K_2S_2O_3$ ); occurs in irregular liver-colored pieces, by exposure absorbs water (moisture), oxygen, and  $CO_2$ , becoming greenish-yellow, finally a gray mass, containing potassium carbonate, hyposulphite, and sulphate; has odor of  $H_2S$  and a bitter, alkaline taste. Dose, gr. 3–10 (.2–.6 Gm.). Applied externally in lotion, bath, ointment. Irritant, increases pulse, cutaneous circulation and heat, also mucous secretions; large doses sedative, laxative. May be used in chronic rheumatism, gout, cutaneous affections, painters' colic, asthma, chronic nasal catarrh, infantile croup, paralysis, scabies, scrofula, chronic bronchitis, whooping-cough, ascari-  
des by injection.

**Potassii Acetas. Potassium Acetate,  $KC_2H_3O_2$ .**—(Syn., Sal Diureticus, Terra Foliata Tartari, Acetas Potassicus (Kalicus); Fr. Acétate de Potasse; Ger. Kalium Aceticum, Kaliumacetat, Essigsauers Kali.)

*Manufacture:* Almost neutralize acetic acid with potassium carbonate (or bicarbonate), evaporate the solution to dryness, and fuse—(1)  $K_2CO_3 + 2HC_2H_3O_2 = 2KC_2H_3O_2 + H_2O + CO_2$ . (2)  $KHCO_3 + HC_2H_3O_2 = KC_2H_3O_2 + H_2O + CO_2$ . It occurs in white powder or crystalline masses of satiny lustre, odorless, warming, saline taste, soluble in 0.4 part water, 2 alcohol, very deliquescent; contains when thoroughly dried 98 p. c. of pure salt. *Assay:* 1 Gm. burnt to carbonate, residue extracted with boiling water, should require for neutralization at least 20.1 Cc.  $\frac{N}{2}$  sulphuric acid V. S., using methyl-orange T. S. indicator. *Impurities:* Heavy metals, arsenic. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.); laxative, ʒij–4 (8–15 Gm.).

**PROPERTIES.**—Diuretic, diaphoretic, aperient, non-irritating, antiscorbutic; renders urine alkaline, preventing and dissolving uric acid precipitates (gravel).

**USES.**—Dropsies (not so good as the bitartrate), acute rheumatism, gout, liver derangements, jaundice, congestion of spleen, uterus, and hemorrhoidal vessels, skin diseases (eczema, psoriasis, lepra), febrile affections, to render urine alkaline. All organic acid salts are believed to be converted into carbonates in the stomach.

**Potassii Citras. Potassium Citrate,  $K_3C_6H_5O_7 + H_2O$ .**—(Syn.,

Kalium Citricum, Citras Potassicus (Kalicus); Fr. Citrate de Potasse; Ger. Kaliumcitrat, Citronsaures Kali.)

*Manufacture*: Saturate to neutrality a solution of citric acid with potassium carbonate (or bicarbonate), filter, evaporate, granulate—  
 (1)  $3K_2CO_3 + 2H_3C_6H_5O_7 \cdot H_2O = 2K_3C_6H_5O_7 \cdot H_2O + 3H_2O + 3CO_2$ .  
 (2)  $3KHCO_3 + H_3C_6H_5O_7 \cdot H_2O = K_3C_6H_5O_7 + 4H_2O + 3CO_2$ . It occurs in transparent, prismatic crystals or white granular powder, odorless, cooling, saline taste, deliquescent, soluble in 0.5 part water, sparingly in alcohol, at 200° C. (392° F.) loses water of crystallization (5.55 p. c.); contains 99 p. c. of pure salt. *Assay*: 1 Gm. burnt to carbonate, residue extracted with boiling water, should require for neutralization at least 18.4 Cc.  $\frac{N}{2}$  hydrochloric acid V. S., using methyl-orange T. S. indicator. *Impurities*: Heavy metals, tartrate. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.); mild laxative,  $\frac{3}{4}$ –2 (4–8 Gm.).

*PREPARATION*.—1. *Potassii Citras Effervescens*. Effervescent Potassium Citrate. (Fr. Citrate de Potasse Effervescent; Ger. Brausendes Kaliumcitrat.)

*Manufacture*: Dry potassium citrate 20 Gm. until it ceases to lose weight, powder and mix with powdered citric acid 16.2, tartaric acid 25.2, then with sodium bicarbonate 47.7, heat in oven 93–104° C. (199–219° F.); when mixture moist from careful manipulation with wooden spatula, rub through No. 6 tinned-iron sieve, dry granules. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.).

*Liquor Potassii Citratis*. Solution of Potassium Citrate.—(Syn., Mistura Potassii Citratis, Neutral Mixture, Liquor Kali Citrici; Fr. Citrate de Potasse liquide; Ger. Kaliumcitratlösung.)

*Manufacture*: Dissolve potassium bicarbonate 8 Gm. and citric acid 6 Gm., each, in distilled water 50 Cc., filter, mix, and when effervescence has nearly ceased transfer to bottle. It is a clear, colorless, aqueous liquid, odorless, mildly saline taste, slightly acid reaction; contains 8 p. c. of anhydrous potassium citrate, with small amounts of citric and carbonic acids. *Assay*: 10.14 Gm. evaporated to dryness, carbonized at low red heat, residue extracted with boiling distilled water, until washings cease to react with methyl-orange T. S., filtrate for neutralization requires 16 Cc.  $\frac{N}{2}$  sulphuric acid V. S., methyl-orange T. S. indicator (each Cc. of V. S. consumed representing 0.5 p. c. of anhydrous salt); should be freshly made when wanted. Dose,  $\frac{3}{4}$ ss–2 (15–60 Cc.).

*PROPERTIES*.—Refrigerant, diaphoretic, diuretic, antiscorbutic, arterial sedative, similar to the acetate.

*USES*.—Febrile affections (this action is increased with sweet spirit of nitre or antimonial wine), remittent, intermittent fevers with hot, dry skin. If given with lemon-juice, beneficial in rheumatism, uric acid diathesis, acute bronchitis (first stages).

*Allied Salt*:

1. *Potassii Sulphis*. Potassium Sulphite,  $K_2SO_3 \cdot 2H_2O$ .—Official 1870–1890.



Made by passing  $\text{SO}_2$  through solution of  $\text{K}_2\text{CO}_3$  until the  $\text{CO}_2$  is expelled, then adding equal weight of  $\text{K}_2\text{CO}_3$ , after which sulphite crystallizes out. It is in opaque octahedral crystals or crystalline powder, odorless, deliquescent, bitter, saline, sulphurous taste.

USES.—Same as sulphites of sodium and magnesium, to which it is inferior. Dose, as a laxative, 3ij–4 (8–15 Gm.).

**Potassii Bitartras.** Potassium Bitartrate,  $\text{KHC}_4\text{H}_4\text{O}_6$ .—(Syn., Cream of Tartar, Acid Potassium Tartrate, Supertartrate of Potassa, Crystals of Tartar, Kali Bitartaricum, Bitartras Potassicus (Kalicus), Cremor Tartari; Br. Potassii Tartras Acidus; Fr. Bitartrate de Potasse, Pierre de Vin; Ger. Tartarus depuratus, Weinstein.)

*Manufacture:* By purifying argol (crude tartar), which deposits in wine casks as a result of fermenting grape-juice. This argol is taken from the sides and bottom of the casks, boiled in water, clay added to precipitate coloring matter, filtered through animal charcoal, crystallized; to remove the 5–15 p. c. calcium tartrate present, dissolve in boiling water, add 8–10 p. c. hydrochloric acid, stir while cooling. It is in colorless or slightly opaque rhombic crystals, or white, gritty powder, odorless, pleasant acidulous taste, permanent, soluble in 200 parts water, sparingly in alcohol; contains 99 p. c. of pure salt. *Assay:* 1 Gm. burnt to carbonate, residue extracted with boiling water, should require for neutralization at least 10.6 Cc.  $\frac{N}{2}$  sulphuric acid V. S., using methyl-orange T. S. indicator. *Impurities:* Heavy metals, alum, calcium phosphate, starch, kaolin, ammonia, phosphates, insoluble matter. Dose, aperient, gr. 10–60 (.6–4 Gm.); hydragogue cathartic, 3ss–4 (2–15 Gm.); diuretic, gr. 10–60 (.6–4 Gm.), ter die.

PREPARATION.—1. *Pulvis Jalapæ Compositus*, 65 p. c.

**Potassii et Sodii Tartras.** Potassium and Sodium Tartrate,  $\text{KNaC}_4\text{H}_4\text{O}_6 + 4\text{H}_2\text{O}$ .—(Syn., Rochelle Salt, Tartarated Soda, Natrokali Tartaricum; Br. Soda Tartarata, Sal Polychrestum Seignetti, Tartras Potassico-sodicus; Fr. Sel de Seignette, Soude Tartarisée; Ger. Tartras natronatus, Kaliumnatriumtartrat, Seignettesalz.)

FIG. 438.



Rochelle salt crystal.

*Manufacture:* Add potassium bitartrate to hot solution of sodium carbonate, to neutralize free acid, thus obtaining normal double tartrate— $2\text{KHC}_4\text{H}_4\text{O}_6 + (\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}) = 2(\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}) + \text{CO}_2 + 3\text{H}_2\text{O}$ ; practically 8 parts potassium bitartrate + 6 sodium carbonate crystals yield 12 crystallized Rochelle salt. It is in colorless, transparent, rhombic prisms, or white powder, odorless, cooling saline taste, soluble in 1.2 parts water, slightly in alcohol, efflorescent; contains 99 p. c. of pure salt.

*Assay:* 1 Gm. burnt to carbonate, residue extracted with boiling distilled water, should require for neutralization at least 14.1 Cc.  $\frac{N}{2}$  hydrochloric acid V. S., using methyl-orange T. S. indicator. *Impurities:* Heavy metals, ammonia. Should be kept in well-stoppered

bottles. Dose, aperient, ʒij–4 (8–15 Gm.); hydragogue cathartic, ʒj (30 Gm.).

**PREPARATION.**—1. *Pulvis Effervescens Compositus*. Compound Effervescing Powder. (Syn., Seidlitz Powder, Pulveres Effervescentes Aperientes; Br. Pulvis Sodæ Tartaratae Effervescens, Effervescent Tartarated Soda Powder; Fr. Poudre gazifère purgative, Poudre de Seidlitz; Ger. Pulvis aërophorus, Laxans or Seidlitzensis, Brausepulver Abführendes, Seidlitzpulver.)

**Manufacture:** Sodium bicarbonate gr. 40 (2.6 Gm.), potassium and sodium tartrate gr. 120 (8 Gm.) mixed and put into a blue paper, + tartaric acid gr. 35 (2.3 Gm.) into a white paper. Should be kept dry in well-closed containers. Dose, 1 powder; dissolve the contents of blue paper in half-glass of water, and to this add contents of white paper—drink while effervescing.

**PROPERTIES.**—Cream of tartar, Rochelle salt, and Seidlitz powders are all diuretic, purgative, refrigerant, antilithic.

**USES.**—Febrile diseases, dropsy, hemorrhoids, vomiting from gastric acidity and pregnancy. Cream of tartar is believed to be eliminated from the system unchanged, hence not so good when alkalinity desired for blood and urine. Small and frequent doses of Rochelle salt simply make urine alkaline.

*Allied Salt:*

1. *Potassii Tartras*. *Potassium Tartrate*,  $K_2C_4H_4O_6 \cdot H_2O$ .—Official 1880–1890. Made by gradually adding to a solution of potassium carbonate (preferably bicarbonate) acid tartrate of potassium until neutral, filtering, concentrating, setting aside to crystallize —  $2KHC_4H_4O_6 + K_2CO_3 = 2K_2C_4H_4O_6 \cdot H_2O + CO_2$ .

**PROPERTIES.**—Diuretic, purgative, aperient. More gentle than sodium or magnesium sulphate.

**USES.**—Hepatic and portal congestion, hemorrhoidal swellings, febrile diseases. Dose, ʒj–8 (4–30 Gm.).

**Potassii Chloras**. **Potassium Chlorate**,  $KClO_3$ .—(Syn., Kali Oxymuriaticum, Kali Muriaticum Oxygenatum, Chloras (Potassicus) Kalicus, Hyperoxymuriate of Potassa; Fr. Chlorate de Potasse; Ger. Kalium chloricum, Kaliumchlorat, Chlorsaures Kali.)

**Manufacture:** Pass chlorine into water holding lime (preferably magnesium oxide) in suspension, thereby forming chloride and hypochlorite, the latter by heat being converted into chlorate and chloride; treat solution with potassium chloride, giving potassium chlorate which crystallizes out, and potassium (magnesium) chloride that remains in solution; magnesium is preferred, as potassium chlorate is less soluble in solution of magnesium chloride than of calcium chloride —  $2Ca(OH)_2 + Cl_4 = Ca(ClO)_2 + CaCl_2 + 2H_2O$ ;  $3Ca(ClO)_2 = Ca(ClO_3)_2 + 2CaCl_2$ ;

FIG. 439.



Potassium chlorate crystal.

$\text{Ca}(\text{ClO}_3)_2 + 2\text{KCl} = 2\text{KClO}_3 + \text{CaCl}_2$ . May also be made by passing electric current into solution potassium chloride. It is in colorless, lustrous, monoclinic prisms or plates, or granular powder, odorless, cooling characteristic taste, soluble in 16 parts water, slightly in diluted alcohol, permanent; contains 99 p. c. of pure salt. *Impurities*: Heavy metals, nitrates, nitrites. Should be kept in well-stoppered bottles, and handled cautiously, as dangerous explosions may occur if heated, subjected to concussion or trituration with organic substances (cork, tannin, sugar, sulphur, antimony sulphide, phosphorus, catechu, glycerin, etc. Dose, gr. 5–20 (.3–1.3 Gm.).

**PREPARATIONS.**—1. *Trochisci Potassii Chloratis*. Troches of Potassium Chlorate. (Syn., Br. Trochiscus Potassii Chloratis; Fr. Tablettes (Pastilles) de Clorate de Potasse; Ger. Pastillen von Chlorsaurem Kali, Kaliumchloratpastillen.)

*Manufacture*: Triturate together sugar 60 Gm., tragacanth 3, mix this, on a sheet of paper with bone spatula, with potassium chlorate 15, add water q. s. 100 troches. Dose, 1–4 troches.

**PROPERTIES.**—Alterative, stimulant, oxidizant, irritant, diuretic, poisonous; converts hæmoglobin into methæmoglobin, disintegrates red corpuscles.

**USES.**—Mercurial salivation and ulcers of the mouth, ulcerated stomatitis, aphthæ, buccal and pharyngeal diphtheria, hemorrhoids, thrush, croup, ozæna, fetid breath, dysentery, vaginitis, cystitis. Internally in scrofula, scarlatina, typhoid fever, cardiac cyanosis, dropsy, blood-poisoning, malignant fevers. Mostly excreted by the kidneys unchanged.

*Poisoning*: Excessive quantities (3ij–4; 8–15 Gm.) produce vomiting, diarrhœa, dyspnœa, heart-failure, cyanosis, nervous disturbance, jaundiced skin, delirium, coma, acute nephritis, death. Induce vomitting and give abundant water, mucilaginous drinks to dilute, opium for pain, amyl nitrite, keep loins warm, avoid renal stimulants.

**Potassii Hypophosphis. Potassium Hypophosphite,  $\text{KH}_2\text{PO}_2$ .**—(Syn., Kalium Hypophosphorum, Hypophosphis (Potassicus) Kalicus; Fr. Hypophosphite de Potasse; Ger. Unterphosphorigsaures Kali.)

*Manufacture*: Mix solutions of potassium carbonate and calcium hypophosphite, getting double decomposition— $\text{Ca}(\text{H}_2\text{PO}_2)_2 + \text{K}_2\text{CO}_3 = 2\text{KH}_2\text{PO}_2 + \text{CaCO}_3$ , filter from the calcium carbonate, evaporate, granulate. It occurs in white, opaque, hexagonal plates, crystalline masses, or granular powder, odorless, pungent, saline taste, very deliquescent; soluble in 0.5 part water, 7 alcohol, insoluble in ether; contains 98 p. c. of pure salt. *Impurities*: Heavy metals, arsenic, carbonate. Should be kept in well-stoppered bottles, and dispensed with caution, as explosion may occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.).

**PREPARATIONS.**—1. *Syrupus Hypophosphitum*. Syrup of Hypophosphites. (Syn., Syrupus Calcii Hypophosphitis Compositus; Fr. Sirop d'Hypophosphite de Chaux composé; Ger. Hypophosphitsirup.)

*Manufacture:* Calcium hypophosphite 4.5 Gm., potassium hypophosphite 1.5, sodium hypophosphite 1.5, diluted hypophosphorous acid 0.2, sugar 65, tincture of fresh lemon-peel 0.5 Cc., water q. s. 100 Cc. Dose,  $\mathfrak{zj}$ -2 (4-8 Cc.).

2. *Syrupus Hypophosphitum Compositus.* Compound Syrup of Hypophosphites. (Syn., Fr. Sirop des Hypophosphites composé; Ger. Zusammengesetzter Hypophosphitsirup.)

*Manufacture:* Rub ferric hypophosphite 2.25 Gm., manganese hypophosphite 2.25 Gm. with sodium citrate 3.75 Gm., add water 30 Cc., heat gently until solution clear, green; dissolve hypophosphites of calcium 35 Gm., potassium 17.5 Gm., sodium 17.5 Gm., in water 450 Cc. + diluted hypophosphorous acid 5 Cc.; dissolve quinine 1.1 Gm., strychnine 0.115 Gm. in water 30 Cc. + 10 Cc. diluted hypophosphorous acid, finally dissolve sugar 775 Gm. in the mixed solutions, strain, add water, q. s. 1,000 Cc. Dose,  $\mathfrak{zj}$ -2 (4-8 Cc.).

3. *Emulsum Olei Morrhue cum Hypophosphitibus*,  $\frac{1}{2}$  p. c.

USES.—Potassium hypophosphite is believed to be of great advantage owing to the phosphorus. Used in phthisis, depleted nerve-power, scrofulous affections, chronic bronchitis, coughs (expectorant).

**Potassii Cyanidum. Potassium Cyanide, KCN.**—(Syn., Cyanuret of Potassium, Kalium Cyanatum, Cyanuretum (Potassicum) Kalicum; Fr. Cyanure de Potassium; Ger. Cyankalium, Kaliumcyanid.)

*Manufacture:* Pass hydrocyanic acid gas (2 parts potassium ferrocyanide + sulphuric acid q. s.) into solution of 1 part potassium hydroxide in 5-6 parts alcohol, wash precipitate with alcohol, or heat together potassium carbonate and potassium ferrocyanide— $\text{K}_2\text{CO}_3 + \text{K}_4\text{Fe}(\text{CN})_6 = 5\text{KCN} + \text{KCNO} + \text{Fe} + \text{CO}_2$ . The cyanate may be removed by alcohol or carbon disulphide, while the iron (Fe) is precipitated to the bottom of the iron retort, so in pouring out the mass must stop short of any iron contamination. It is in white, opaque, amorphous pieces or white, granular powder, odorless when dry, if moist exhales odor of hydrocyanic acid, sharp alkaline taste, soluble in 2 parts water, sparingly in alcohol, deliquescent; contains 95 p. c. of pure salt. *Assay:* 1 Gm. dissolved in distilled water q. s. 100 Cc., of this 64.7 Cc. + ammonia water 5 Cc. + 3 drops potassium iodide T. S., should require at least 47.5 Cc.  $\frac{\text{N}}{\text{V}}$  silver nitrate V. S. before acquiring permanent precipitate (each Cc. of V. S. indicating 2 p. c. of pure salt). *Impurities:* Carbonate (HCl), ferrocyanide ( $\text{Fe}_2\text{Cl}_6$ , blue), sulphocyanate ( $\text{Fe}_2\text{Cl}_6$ , red). Should be kept in well-stoppered bottles labelled poison and handled with great care. Dose, gr.  $\frac{1}{16}$ — $\frac{1}{8}$  (.004-.008 Gm.), dissolved in water.

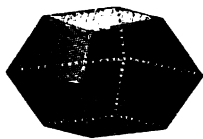
PROPERTIES.—Same as hydrocyanic acid as a poison and medicine. Sedative, anodyne, antispasmodic.

USES.—Headache from dyspepsia or menstruation.

*Poisoning:* Similar to hydrocyanic acid. Place in recumbent position, give fresh air, emetics, atropine as an antidote, stimulants (ether, brandy, warmth, inhale ammonia), demulcents.

**Potassii Ferrocyanidum.** Potassium Ferrocyanide,  $K_4Fe(CN)_6 + 3H_2O$ .—(Syn., (Yellow) Prussiate of Potash, Kalium Borussicum, Cyanuretum Ferroso-potassicum, Ferrocyanuret (Ferroproussiate) of Potassium, Prussiate of Potassa; Fr. Proto-cyanure jaune de Fer et de Potassium; Ger. (Gelbes) Blutlaugensalz.)

FIG. 440.



Potassium ferrocyanide crystal.

**Manufacture:** Heat together potassium carbonate (pearl-ash), nitrogenous animal refuse (dried blood, hoofs, etc.), and iron scraps; the fused mass (melt) is lixiviated and this solution evaporated for crystallization—(1)  $6KCN + Fe + 2H_2O = K_4Fe(CN)_6 + 2KOH + H_2$ , or (2)  $6KCN + FeS = K_4Fe(CN)_6 + K_2S$ . Now very

largely obtained from the mass of ferric hydroxide used to purify illuminating gas, as that absorbs cyanogen compounds forming ferrocyanides, etc. It is in large, soft, transparent, yellow, 4-sided, monoclinic tabular crystals or prisms, odorless, mild saline taste, soluble in 4 parts water, insoluble in alcohol, efflorescent; contains 99 p. c. of pure salt. **Impurities:** Carbonate, ferricyanide. Should be kept in well-stoppered bottles. Dose, gr. 10–15 (.6–1 Gm.), ter die.

**PREPARATION.**—1. *Acidum Hydrocyanicum Dilutum.* Diluted Hydrocyanic Acid, HCN. (Syn., Prussic Acid, Acidum Hydrocyanatum (Borussicum), Cyanhydric Acid; Fr. Acide cyanhydrique (hydrocyanique); Ger. Cyanwasserstoffsäure, Blausäure.) A liquid composed of 2 p. c., by weight, of absolute hydrocyanic acid (HCN) and 98 p. c. of water.

**Manufacture:** 1. *Extemporaneously.*—Mix diluted hydrochloric acid 15.54 Cc. with distilled water 44.10 Cc., add silver cyanide 6 Gm., shake, reject the precipitate— $AgCN + HCl = HCN + AgCl$ . 2. *Commercially.*—Heat potassium ferrocyanide 20 Gm. + sulphuric acid 8 Cc. + water 65 Cc., pass evolved gas into distilled water 65 Cc. It is a colorless liquid, characteristic odor resembling bitter-almonds, volatile, very unstable and poisonous; use care in tasting. **Test:** 1. To 1 Cc. add potassium hydroxide T. S. for alkalinity, + few drops ferrous sulphate T. S., boil, acidify with hydrochloric acid, getting blue precipitate. **Assay:** To 5 Gm. add distilled water q. s. 50 Cc., of this 26.9 Cc. + 5 Cc. ammonia water + 3 drops potassium iodide T. S., should require 10 Cc.  $\frac{N}{10}$  silver nitrate V. S. to produce slight permanent precipitate. **Impurities:** Sulphuric and hydrochloric acids. Should be kept cool, in small, dark amber-colored, cork-stoppered vials. Dose,  $\mathfrak{m}$ j–3 (.06–.2 Cc.), in water or alcohol. An acid of 5 p. c. is manufactured, but it is even less stable and reliable than the official.

**PROPERTIES.**—Potassium ferrocyanide—not used much medicinally, although when pure non-poisonous; the commercial salt is sometimes valuable in checking the colliquative sweats of phthisis, also important as a test for copper, zinc, and ferric salts, and as a source of cyanogen compounds. Hydrocyanic acid (and all cyanides)—anæsthetic, sedative,

anodyne, antispasmodic. On unbroken skin, mouth, and stomach paralyzes sensory nerve-endings; small doses slow the heart by stimulating inhibitory centres; large doses may cause diastolic arrest (instantaneous death) by paralyzing the heart directly, and cardiac centre in the medulla. Quickly enters blood, causing all to be bright red (arterial tint), then going to dark venous color. The venous becomes red, owing to its hæmoglobin being oxidized; the arterial becomes dark owing to its oxygen being replaced by carbon dioxide; may produce dermatitis.

USES.—Phthisis, dyspnœa, cough, asthma, whooping-cough, chronic catarrh, nervous cough, angina pectoris, gastralgia, skin diseases.

*Poisoning*: Symptoms established within a half to two minutes—giddiness, stupor, complete insensibility, eyes fixed, glistening, pupils dilated, dyspnœa, limbs flaccid, skin cold, clammy, respiration slow, deep, convulsive, pulse weak, slow, almost imperceptible, convulsions, paralyzed spine, death from asphyxia (from paralysis of respiratory centre), breath has bitter-almond odor. If possible, wash out stomach, emetics, atropine hypodermically, gr.  $\frac{1}{50}$  (.0013 Gm.), ether, brandy, ammonia inhalations, chlorine water, artificial respiration and heat, cold water alternately on chest and spine, electricity; ferrous and ferric sulphates, followed by  $K_2CO_3$  solution = insoluble Prussian blue (antidote). Rapidly eliminated by lungs and kidneys.

*Incompatibles*: Atropine, diffusible stimulants; copper, iron, and silver salts, cobalt nitrate, red mercuric oxide and sulphide.

*Synergists*: Cardiac and motor depressants.

**Potassii Dichromas.** Potassium Dichromate,  $K_2Cr_2O_7$ .—(Syn., Potassii Bichromas, U. S. P. 1890, Red Chromate of Potash, Kali Chromicum Rubrum, Bichromas Kalicus; Fr. Bichromate de Potasse; Ger. Kalium dichromicum, Kaliumdichromat, Doppeltchromsaures Kali, Zweifach Chromsaures Kali.)

*Manufacture*: Heat together potassium carbonate, lime, and powdered chrome iron ore which has previously been roasted; the iron is oxidized into ferric oxide, and chromium into chromic acid; this latter attacks the potassium carbonate forming the neutral chromate, which is treated with an acid ( $H_2SO_4$  or  $HNO_3$ ) to get the acid or bichromate—(1)  $2FeO \cdot Cr_2O_3 + 4K_2CO_3 + O_7 = Fe_2O_3 + 4CO_2 + 4K_2CrO_4$ . (2)  $2K_2CrO_4 + H_2SO_4 = K_2Cr_2O_7 + K_2SO_4 + H_2O$ .

It occurs in large, orange-red, transparent, triclinic prisms, or 4-sided tabular crystals, odorless, acidulous metallic taste, soluble in 9 parts water, insoluble in alcohol, permanent; contains 99 p. c., of pure salt. *Tests*: 1. At white heat evolves oxygen, leaving neutral potassium chromate and green chromic oxide. 2. Sodium cobaltic nitrate T. S. gives yellow precipitate. Should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{5}$  (.0013 Gm.), in pill.

**PREPARATION.**—1. *Chromii Trioxidum.* Chromium Trioxide,  $CrO_3$ . (Syn., Acidum Chromicum, U. S. P. 1890, Chromic Trioxide, Anhydrous Chromic Acid; Br. Chromic Anhydride; Fr. Acide chromique; Ger. Chromsäure.)

**Manufacture:** Mix cold saturated solution of potassium dichromate 100 vols., with sulphuric acid 150 vols., let cool; chromic anhydride deposits in crystals— $K_2Cr_2O_7 + 2H_2SO_4 = 2CrO_3 + 2KHSO_4 + H_2O$ . It occurs in small, needle-shaped crystals or rhombic prisms, dark

FIG. 441.



Potassium dichromate crystal.

purplish-red color, metallic lustre, odorless, destructive to animal and vegetable tissues, deliquescent, soluble in water, forming orange-red solution, blackens with heat, but color restored upon cooling, at  $250^{\circ}C.$  ( $482^{\circ}F.$ ) decomposes into green chromic oxide and free oxygen, warmed with hydrochloric acid liberates chlorine; contains 90 p. c. of pure salt.

**Assay:** Dissolve 1 Gm. in 100 Cc. water, of this 8.3 Cc. + 2 Cc. hydrochloric acid + 1 Gm. potassium iodide, shaken a few minutes, should require, after diluting with 100 Cc. water + 5 Cc. starch T. S., 22.5 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to change deep blue color to light green (each Cc. of V. S. indicating 4 p. c. of pure salt). **Impurities:**

Sulphuric acid, etc. Should be kept in glass-stoppered bottles, out of contact with organic substances, as cork, tannin, sugar, alcohol, ether, glycerin, etc., to avoid explosion, as it readily yields oxygen.

**PROPERTIES.**—Potassium dichromate—irritant, caustic, alterative, expectorant; Chromium trioxide—antiseptic, disinfectant, deodorant, coagulates albumin, caustic, escharotic; action slow but penetrating.

**USES.**—Potassium dichromate in secondary syphilis; externally as caustic in tubercular enlargements, excrescences, warts, syphilitic sores, sloughing wounds. Largely used in calico-printing, pigments, etc. Workmen employed in its manufacture often suffer from ulcers on hands, face, nares, etc., from the irritating fumes.

Chromium trioxide is used very similarly as an escharotic for ulcers, bites of rabid animals, poisoned wounds, oozæna, condylomata, nasal polypi, leucorrhœa, gonorrhœa, gangrenous sores, sweating of tender feet.

**Poisoning:** Have a violent irritative, corrosive condition; vomiting, hemorrhagic dejections, abdominal pains, dilated pupils, great depression, collapse, poor circulation, coma, heart failure, death. Give emetic, alkaline carbonate (bicarbonate), or magnesium oxide, chalk, demulcent drinks, milk, egg-white, stimulants, heat, opium.

**Potassii Sulphas.** Potassium Sulphate,  $K_2SO_4$ .—(Syn., Vitriolated Tartar, Tartarum Vitriolatum, Arcanum Duplicatum, Sal Polychrestum Glaseri, Sulfas (Potassicus) Kalicus; Fr. Sulfate de Potasse, Potasse vitriolée; Ger. Kalium sulfuricum, Kaliumsulfat, Schwefelsaures Kali.)

**Manufacture:** By decomposing potassium carbonate, nitrate, or chloride with sulphuric acid, or by neutralizing sulphuric acid with potassium hydroxide, or from kainite, but its greatest source is as a

by-product in the manufacture of nitric acid—(1)  $K_2CO_3 + H_2SO_4 = K_2SO_4 + H_2O + CO_2$ . (2)  $2KCl + H_2SO_4 = 2HCl + K_2SO_4$ . (3)  $2KNO_3 + H_2SO_4 = K_2SO_4 + 2HNO_3$ . (4)  $KNO_3 + H_2SO_4 = KHSO_4 + HNO_3$ . In this last formula the acid sulphate has to be converted into normal sulphate— $2KHSO_4 + K_2CO_3 = 2K_2SO_4 + CO_2 + H_2O$ . It is in hard, colorless, transparent, 6-sided, rhombic prisms, terminated by pyramids, or in a white powder, odorless, bitter, saline taste, permanent; soluble in 9 parts water, insoluble in alcohol; contains 99 p. c. of pure salt. *Impurities*: Heavy metals, arsenic.

**PROPERTIES.**—Mild purgative, cholagogue, operating usually without pain, heat, or perceptible irritation.

**USES.**—Given after labor and for drying up mammary secretion, dyspepsia, biliousness, albuminuria. Owing to hardness, it is used for pulverizing tough vegetable substances, like ipecacuanha. Usually prescribed with rhubarb, etc. Dose, 3ss–4 (2–15 Gm.).

FIG. 442.



Potassium sulphate crystal.

**Potassii Bromidum. Potassium Bromide, KBr.**—(Syn., Bromuretum (Potassicum) Kalicum; Fr. Bromure de Potassium; Ger. Kalium bromatum, Kaliumbromid, Bromkalium.)

**Manufacture:** Add bromine to solution potassium hydroxide until liquid remains colored, thereby producing bromide and bromate, evaporate to dryness, mix with charcoal, heat to redness, thus converting all of the bromate into bromide—(1)  $6KOH + 6Br = 5KBr + KBrO_3 + 3H_2O$ . (2)  $2KBrO_3 + 6C = 2KBr + 6CO$ . The KBr is dissolved out of the mass with water, and solution allowed to crystallize. The salt may also be made by decomposing bromide of iron with potassium carbonate— $K_2CO_3 + FeBr_2 = 2KBr + FeCO_3$ . The iron carbonate is precipitated, while potassium bromide remains in solution. It is in colorless or white cubical crystals or granular powder, odorless, strongly saline taste, soluble in glycerin, 1.5 parts water, 180 alcohol; permanent, decrepitates; contains 97 p. c. of pure salt. *Impurities*: Heavy metals, barium, alkalies, bromate, iodides. *Assay*: 0.3 Gm. dissolved in 50 Cc. water, + 2–3 drops potassium chromate T. S., should require at least 24.6–25.85 Cc.  $\frac{N}{10}$  silver nitrate T. S. to produce a permanent red color. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.), ter die, in water, elixir, or syrup. In strychnine-poisoning give 3ij–4 (12–15 Gm.) at once, in tetanus the same amount within 24 hours.

**PROPERTIES.**—Sedative, hypnotic, anæsthetic, narcotic, antiseptic, anaphrodisiac. All bromides in the stomach and intestines are converted quickly into sodium bromide, and as such are absorbed. Large doses lessen force and frequency of heart-beat, causing a stoppage in diastole. Eliminated by kidneys, skin, intestinal and bronchial mucous membranes, in saliva, milk.



**Uses.**—Epilepsy, hysterical, infantile, and puerperal convulsions, neuralgia, insanity, delirium tremens, chorea, tetanus, sunstroke, hysteria, whooping-cough, spasmodic asthma, vomiting of phthisis, seasickness, nervousness, angina pectoris, diabetes, seminal emissions, priapism, incontinence of urine, in teething, toothache, urticaria, acne, intermittent fever, enlarged spleen, amblyopia, diphtheria, to anæsthetize the pharynx, larynx, urethra, irritable bladder, enlarged prostate, gangrenous sores, strychnine-poisoning. After prolonged use may have *bromism*, which consists of muscular weakness, mental and bodily sluggishness, loss of memory, stupidity, depressed spirits, apathy, low temperature, with patient recumbent in bed, prostrated and almost lifeless; fetid breath, coated tongue, and acneiform eruption are its first constitutional symptoms, which may largely be aborted by Fowler's solution  $\text{Mj-5}$  (.06–.3 Cc.) with each dose of bromine.

**Poisoning:** Withdraw drug, give diuretics, cathartics, tonics, iron, strychnine, cardiac stimulants, strong coffee, caffeine citrate, digitalis, morphine (best antagonist to mental symptoms), ergot, atropine.

**Incompatibles:** Motor excitants, cardiac stimulants, acids, acidulous and metallic salts.

**Synergists:** Opium, hypnotics, cardiac depressants.

**Potassii Iodidum. Potassium Iodide, KI.**—(Syn., Kali Hydriodicum, Ioduretum (Potassium) Kalicum; Fr. Iodure de Potassium; Ger. Kalium jodatium, Kaliumjodid, Jodkalium.)

**Manufacture:** Add iodine to hot solution potassium hydroxide until dark brown color is permanent, thus producing iodide and iodate; this solution is evaporated to dryness, mixed with charcoal, and heated to redness, in order to convert all iodate into the iodide—(1)  $6\text{KOH} + 6\text{I} = 5\text{KI} + \text{KIO}_3 + 3\text{H}_2\text{O}$ . (2)  $2\text{KIO}_3 + 6\text{C} = 2\text{KI} + 6\text{CO}$ . The KI is dissolved out of the mass with boiling water, and solution set aside to crystallize; may also be prepared by action of ferrous iodide and potassium carbonate, or from the mother-liquors of Chile saltpetre. It is in colorless, transparent, translucent, or opaque white crystals or granular powder, faint, iodine-like odor, pungent, saline, bitter taste, soluble in 0.7 part water, 12 alcohol, 2.5 glycerin, permanent, decrepitate; contains 99 p. c. of pure salt; when crystallized from alkaline solution it is opaque and less pure. **Assay:** Dissolve 0.5 Gm. in 10 Cc. distilled water, + 3 drops potassium chromate T. S., should require 30–30.8 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to produce permanent red color (corresponding to at least 99 p. c. of pure salt. **Impurities:** Heavy metals, barium, alkalis, nitrates, nitrites, chlorides, bromides, cyanide, thio-sulphate, iodate, less soluble salts. **Dose,** gr. 2–30 (.13–2 Grm.), ter die, largely diluted; in syphilis may give  $\text{3ij-4}$  (8–15 Gm.) daily, well diluted with water, milk, or compound syrup of sarsaparilla.

**PREPARATIONS.**—1. *Unguentum Potassii Iodidi.* Ointment of Potassium Iodide. (Syn., Fr. Pomatum cum Iodureto Potassico, Pommade d'Iodure de Potassium; Ger. Unguentum Kalii jodati, Kaliumjodidsalbe, Jodkaliumsalbe.)

*Manufacture*: 10 p. c. Dissolve potassium iodide 10 Gm., potassium carbonate .6, in water 10, by trituration, gradually add benzoinated lard 80, incorporate thoroughly; should be prepared extemporaneously.

2. *Acidum Hydriodicum Dilutum. Diluted Hydriodic Acid, HI.* (Syn., Fr. Acide hydroiodique dilué; Ger. Verdünnte Jodwasserstoffsäure.) A solution of hydriodic acid, containing not less than 10 p. c., by weight, of absolute acid, and 90 p. c. of water.

*Manufacture*: Dissolve with heat potassium iodide 13.5 Gm., potassium hypophosphite 1 Gm., in distilled water 25 Cc.; dissolve tartaric acid 13.65 Gm. in diluted alcohol 40 Cc., which pour into a bottle, add thereto first solution, place bottle in ice water several hours, filter, wash precipitate with diluted alcohol until 100 Gm. clear solution obtained, evaporate off alcohol, add distilled water q. s. 100 Gm.— $KI + KH_2PO_3 + 2H_2C_4H_4O_6 = HI + HH_2PO_3 + 2KHC_4H_4O_6$ ; here are formed hydriodic and hypophosphorous acids, and acid potassium tartrate, the removal of latter being facilitated by the alcohol and cold; the potassium hypophosphite is added to preserve acid solution, as the hypophosphorous acid present therefrom (.63 p. c.) reconverts any free iodine that might possibly be liberated. It is a clear, colorless, odorless, acid liquid, sp. gr. 1.106, miscible with water, alcohol; at 127° C. (261° F.) an acid of 57.5 p. c. distills over unchanged, residue 1 p. c.

*Tests*: 1. Silver nitrate T. S. gives yellow, curdy precipitate, insoluble in nitric acid, almost so in ammonia water, but soluble in solutions of sodium thiosulphate and potassium cyanide. 2. Few drops ferric chloride T. S., or chlorine water, added to 3 p. c. acid solution, liberates iodine giving reddish-brown color, agitated with few drops chloroform the latter acquires violet color. *Assay*: 2.54 Gm. + 50 Cc. distilled water, + 25 Cc.  $\frac{N}{10}$  silver nitrate V. S., + 5 Cc. ferric ammonium sulphate T. S., + 3–4 Cc. nitric acid, stopper, shake well, not more than 5 Cc.  $\frac{N}{10}$  potassium sulphocyanate V. S. should be required to produce permanent reddish-brown tint (each Cc.  $\frac{N}{10}$  silver nitrate V. S. consumed corresponding to 0.5 p. c. of absolute acid). *Impurities*: Heavy metals, barium, arsenic, sulphuric acid. Should be kept dark, in amber-colored, glass-stoppered bottles. Dose,  $\mathfrak{m}$ v–30 (.3–2 Cc.). Absolute hydriodic acid is a colorless, irrespirable, non-inflammable gas, sp. gr. 4.44, having odor of hydrochloric acid; strongest solution obtainable is 57.75 p. c.

*Prep.*: 1. *Syrupus Acidi Hydriodici.* Syrup of Hydriodic Acid.—

(Syn., Fr. Sirop d'Acide iodhydrique; Ger. Jodwasserstoffsirup.)

*Manufacture*: Mix diluted hydriodic acid 10 Gm., water 30, syrup 60. It is a transparent, colorless, or pale straw-colored, syrupy liquid, sweet, acidulous taste, sp. gr. 1.190; contains 1 p. c., by weight, of absolute acid. *Assay*: To 31.73 Gm. add distilled water, q. s. 50 Cc., to 10 Cc. of this add 10 Cc. distilled water + 8 Cc.  $\frac{N}{10}$  silver nitrate V. S., + 5 Cc. diluted nitric acid, + 3 Cc. ferric ammonium sulphate T. S., shake, then 3 Cc.  $\frac{N}{10}$  potassium sulphocyanate V. S. should be required to produce permanent reddish-brown tint (each Cc.  $\frac{N}{10}$  silver nitrate V. S. consumed corresponding to 0.2 p. c. of absolute acid). *Impurities*: Free iodine, etc. Dose,  $\mathfrak{zj}$ –2 (4–8 Cc.).

3. *Liquor Iodi Compositus*, 10 p. c. 4. *Tinctura Iodi*, 5 p. c. 5. *Unguentum Iodi*, 4 p. c.

*Unoff. Prep.*: *Linimentum Potassii Iodidi cum Sapone* (Br.), 10 p. c.

PROPERTIES.—Alterative, stimulant, absorbent, irritant.

USES.—Specific in rheumatism, nervous diseases, secondary and tertiary syphilis, mercurial tremors and sore mouth, lead-poisoning and palsy, aneurism of the aorta, dropsy, granular meningitis, chronic hydrocephalus, brain tumors, priapism, muscular rheumatism, sciatica, angina pectoris, heart diseases, gout, pneumonia, chronic bronchitis, asthma, paralysis, cord sclerosis. Hydriodic Acid and Syrup—similar to iodine and iodides, but less offensive to stomach and taste; chiefly as alterative in scrofula, chronic bronchitis, malarial poisoning, etc. All preparations and compounds containing iodine, iodide of potassium, etc., when given in large repeated doses produce constitutional symptoms known as *iodism*, preceded by coryza and pain over the brow, sore throat, fetid breath, swollen gums, eruptive acne, neuralgia, emaciation, cardiac palpitation.

*Poisoning, Incompatibles*: Same as for iodine, see page 694

**Potassii Nitras.** Potassium Nitrate,  $\text{KNO}_3$ .—(Syn., Saltpetre, Nitre, Nitras (Potassicus) Kalicus, Sal (Petræ) Nitri, Nitrum Depuratum; Fr. Azotate (Nitrate) de Potasse, Nitre prismatique; Ger. Kalium nitricum, Kaliumnitrat, Salpetersaures Kali, Kalisalpeter.)

*Manufacture*: While this may be made by neutralizing nitric acid with potassium carbonate, yet by far the greater part of that used is found as a neutral salt in Chile, Peru, India, etc. Some of this supply, however, is a product of nitre beds, which consist of a mechanical mixture of animal refuse, earth, and lime, protected under cover. By

putrefaction ammonia is formed, which, upon oxidation, becomes nitric acid and unites with the calcium; this is dissolved out and decomposed with potassium carbonate or chloride— $\text{Ca}(\text{NO}_3)_2 + \text{K}_2\text{CO}_3 = 2\text{KNO}_3 + \text{CaCO}_3$ . Saltpetre may also be obtained from Chile saltpetre by double decomposition— $\text{NaNO}_3 + \text{KCl} = \text{KNO}_3 + \text{NaCl}$ . It is colorless, transparent, 6-sided, rhombic prisms, or white crystalline powder, odorless, cooling, saline, pungent taste, soluble in 3.6 parts water, slightly in alcohol, hygroscopic; when fused into round moulds is called *sal prunelle* (*nitrum tabulatum*); contains 99 p. c. of pure salt. *Impurities*: Heavy metals, iodide, chlorate, perchlorate. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).



Potassium nitrate crystal.

PREPARATION.—1. *Argenti Nitras Mitigatus*, 66 p. c.

PROPERTIES.—Refrigerant, diuretic, diaphoretic, antiseptic, purgative, nervous sedative, cardiac depressant (causing fewer and feebler beats), irritant, alterative; enters blood unchanged; eliminated by kidneys unchanged.

USES.—Acute rheumatism, pneumonia, fevers (acetate and citrate preferable), dropsy, stomatitis, bronchitis, freckles, bruises, abrasions, scurvy, angina, asthma, gout, gonorrhœa, incontinence of urine, manufacture of gunpowder. The once official charta mostly burnt for asthma.

**Potassii Permanganas.** Potassium Permanganate,  $\text{KMnO}_4$ .—(Syn., Hypermanganas (Potassicus) Kalicus; Fr. Permanganate de Potasse; Ger. Kalium permanganicum, Kaliumpermanganat, Uebermangansaures Kali.)

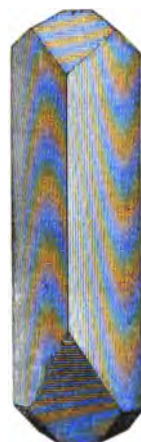
*Manufacture*: Fuse manganese dioxide with potassium carbonate (or hydroxide) and potassium chlorate (or nitrate). The manganese is converted into manganic acid, which, combining with the alkali, forms potassium manganate; this can be dissolved out by water, giving a dark emerald-green solution, and crystallized. If this solution now be acidified ( $\text{H}_2\text{SO}_4$ ) or boiled with much water, it becomes red and contains in solution  $\text{KMnO}_4$  and a precipitate of  $\text{MnO}_2$ .—  
 (1)  $3\text{MnO}_2 + 3\text{K}_2\text{CO}_3 + \text{KClO}_3 = 3\text{K}_2\text{MnO}_4 + \text{KCl} + 3\text{CO}_2$ .  
 (2)  $3\text{K}_2\text{MnO}_4 + 2\text{H}_2\text{SO}_4 = 2\text{KMnO}_4 + 2\text{K}_2\text{SO}_4 + \text{MnO}_2 + 2\text{H}_2\text{O}$ , or  $3\text{K}_2\text{MnO}_4 + 2\text{H}_2\text{O} = 2\text{KMnO}_4 + \text{MnO}_2 + 4\text{KOH}$ . It is in slender, monoclinic prisms, dark purple color, almost opaque by transmitted light, blue metallic lustre by reflected light, odorless, sweet, disagreeable, astringent taste, soluble in 15 parts water, decomposed by alcohol, permanent, decrepitates when heated, yielding oxygen, potassium manganate, and manganese dioxide; contains 99 p. c. of pure salt. *Assay*: Dissolve 0.1 Gm. in 100 Cc. hot distilled water, + 1 Cc. sulphuric acid, should require for decolorization at least 31.5 Cc.  $\frac{\text{N}}{10}$  oxalic acid V. S. *Impurities*: Chloride, nitrate, sulphate. Should be kept dark, in glass-stoppered bottles, and when dry or in concentrated solution should not be brought in contact with organic or other readily oxidizable substances. Dose, gr. 2–5 (.13–.3 Gm.), given on a full stomach in much water, or pill made with kaolin, soft paraffin, or wool-fat.

*PREPARATION*.—(Unoff.) *Liquor Potassii Permanganatis* (Br.); 10 p. c.

*PROPERTIES*.—Disinfectant, deodorant, antiseptic, caustic, stimulant, emmenagogue; liberates much of its oxygen as ozone.

*USES*.—Externally—fetid and gangrenous ulcers, wounds, abscesses, carbuncles, gonorrhœa, leucorrhœa, otorrhœa, diphtheria, cancerous ulcers, eczema. Internally—diphtheria, scarlatina, atonic amenorrhœa, antidote to morphine, opium (by mouth; of little value by rectum, and still less hypodermically), phosphorus, serpents' bites and rabies poisoning. The stains can be resolved by weak acid solutions (oxalic, hydrochloric), lemon-juice, etc. It oxidizes to the extent of its available oxygen, forming harmless compounds.

FIG. 444.



Potassium permanganate crystal.

## SODIUM (NATRIUM).

Na<sup>1</sup> = 23.

The metallic element sodium (L. *sod-a*, + *ium*, fr. *solidus*, contr. *sodo*, solid, hard, *sod-ash*, residue from burning masses or *sods* of marine plants) is not itself official, but many of its salts are. It is diffused widely in nature in the form of various compounds, occurring in the atmosphere, soil, spring- and sea-waters, rock and common salt, mainly as the chloride. We have also the native nitrate and silicate.

All of these are more abundant and soluble than potassium salts, and, like them, are dissolved by rain-water, which, in its onward movement, dissolves and deposits some of them almost everywhere. The metal is obtained similarly to potassium (heating carbonate with carbon, etc.), with which it is universally distributed.

*Tests for Sodium Salts.*—1. Sodium salts are all soluble in water, consequently cannot be precipitated by any reagent. 2. The main test is that all compounds impart a yellow color to a colorless Bunsen flame, and the spectroscope gives a characteristic yellow line. 3. Sodium compounds are white, soluble in water, and non-volatile at a red heat.

**Sodii Boras.** Sodium Borate,  $\text{Na}_2\text{B}_4\text{O}_7 + 10\text{H}_2\text{O}$ .—(Syn., Borax, Sodæ Biboras, Sodium Biborate, Sodium Tetra or Pyroborate, Natrium Biboricum (Biboracium), Boras Sodicus; Fr. Borate de Soude, Sel de Perse; Ger. Borsures Natron, Natrium (pyroborat)-borat.)

FIG. 445.



Sodium borate crystal.

*Manufacture:* This salt, natively called tincal, is found in Thibet, Persia, California, etc., occurring as a saline incrustation on lake shores and as crystals in the blue mud of Clear Lake. The large crystals are picked out, washed with sodium hydroxide solution to remove fatty matter, and the saturated earth lixiviated, the solution evaporated and crystallized; may also be made from the natural borates—boracite, borosodocalcite, cryptomorphite, etc., of Nevada, S. America, Europe, Asia. Mostly prepared from crude boric acid of Tuscany by fusing with sodium carbonate— $4\text{H}_3\text{BO}_3 + \text{Na}_2\text{CO}_3 =$

$\text{Na}_2\text{B}_4\text{O}_7 + \text{CO}_2 + 6\text{H}_2\text{O}$ . It is in colorless, transparent, monoclinic prisms, or white powder, inodorous, sweet, alkaline taste, effloresces in warm air; soluble in 20.4 parts water, 1 glycerin; insoluble in alcohol, heated to redness loses water of crystallization (47 p. c.), fusing to colorless glass; contains 99 p. c. of pure sodium tetraborate. *Impurities:* Heavy metals, carbonate, bicarbonate, nitrate, phosphate. Should be kept in well-stoppered bottles. Dose, gr. 5–30 (.3–2 Gm.).

*PREPARATIONS.*—1. *Unguentum Aquæ Rosæ*, 5 p. c.

*Unoff. Preps.:* *Glycerinum Boracis* (Br.), 15 p. c. *Mel Boracis* (Br.), 11 p. c.

**PROPERTIES AND USES.**—Identical with boric acid, disinfectant, antiseptic, astringent, dysmenorrhœa, uric acid diathesis, epilepsy, gravel; locally in aphthous ulceration, diphtheria, inflammation of the mouth, infantile diarrhœa, cystitis, ulcers, urethral and vaginal inflammations, scaly skin diseases (psoriasis, impetigo, eczema, etc.), prurigo pudendi, leucorrhœa, itching in urticaria, pruritus scroti et ani, conjunctivitis, gonorrhœa.

*Incompatibles:* Precipitates alkaloids, atropine, cocaine, morphine, quinine, etc., except in presence of glycerin, gelatinizes acacia, mucilage, decomposes alkali carbonates with effervescence, in presence of glycerin.

**Sodii Nitras. Sodium Nitrate,  $\text{NaNO}_3$ .**—(Syn., Cubic Nitre, Nitrum Cubicum, Nitras (Azotus) Sodicus; Fr. Azotate (Nitrate) de Soude, Nitre cubique; Nitrate de Chile; Ger. Natrium nitricum, Natriumnitrat, Chile Salpeter.)

*Manufacture:* Found native in Chile, Peru, etc., as a stratum (terra salitrosa) composed of various salts, from which the sodium nitrate is extracted by boiling water, and crystallized. It is in colorless, transparent rhombohedral crystals, odorless, cooling, saline, slightly bitter taste, hygroscopic, soluble in 1.1 parts water, 100 alcohol, at high temperature evolves oxygen, being reduced to nitrite, deflagrates with charcoal; contains 99 p. c. of pure salt. *Impurities:* Heavy metals, iodide. Should be kept in well-stoppered bottles. Dose, as a purgative during the day,  $\text{ʒiv}$ –8 (15–30 Gm.); for other affections, gr. 15–30 (1–2 Gm.).



FIG. 446.

Sodium nitrate crystal.

**PREPARATION.**—1. *Liquor Sodii Phosphatis Compositus*, 4 p. c.

**PROPERTIES AND USES.**—Refrigerant, diuretic, purgative; dysentery, epilepsy, angina pectoris, laryngitis, diarrhœa.

**Sodii Nitris. Sodium Nitrite,  $\text{NaNO}_2$ .**—(Syn., Fr. Nitrite de Soude; Ger. Salpetrigsaures Natron.)

*Manufacture:* Heat together sodium nitrate, charcoal, and starch, wash out the nitrite with water; or may add to fused sodium nitrate pure lead in sheets, then fuse  $3\frac{1}{2}$  hours, lixivate the mass with water until solution has sp. gr. 1.342, add  $\text{HNO}_3$ , concentrate to sp. gr. 1.414, clarify by subsidence, and allow to crystallize. It is in white opaque fused masses, or pencils, or colorless transparent hexagonal crystals, odorless, saline taste, deliquesces, oxidizes to sodium nitrate, soluble in 1.4 parts water, slightly in alcohol, at red heat decomposes into oxygen, nitrogen, nitrogen dioxide, sodium oxide; contains 90 p. c. of pure salt. *Assay:* 1 Gm. + distilled water 100 Cc., of this 10 Cc. + 30 Cc.  $\frac{\text{N}}{10}$  potassium permanganate V. S. diluted with distilled water 150 Cc. + sulphuric acid 5 Cc., heated to  $40^\circ \text{C}$ . ( $104^\circ \text{F}$ .), after five minutes, should require 3.75 Cc.  $\frac{\text{N}}{10}$  oxalic acid V. S. to decolorize solution (each Cc. of potassium permanganate consumed corresponding to 0.0034285 Gm. of pure salt.) *Impurities:*

Heavy metals, etc. Should be kept in well-stoppered bottles. Dose, gr. 2-3 (.13-.2 Gm.), *ter die*.

PREPARATION.—1. *Spiritus Aetheris Nitrosi*.

PROPERTIES AND USES.—Similar to nitroglycerin and amyl nitrite, but is milder and more uniform; angina pectoris, asthma, dyspnoea, headache, hemicrania, epilepsy; dilates the vessels, lowers blood-pressure.

**Sodii Chloridum. Sodium Chloride, NaCl.**—(Syn., Common, Table or Sea Salt, Muriate of Sodium, Sal (Commune) Culinaire, Chloruretum Sodicum; Fr. Chlorure de Sodium, Hydro-chlorate de Soude, Sel de Cuisine, Sel commun ou marin; Ger. Natrium chloratum (purum), Natriumchlorid, Chlornatrium, Kochsalz.)

*Manufacture:* Found native everywhere, being the most abundant sodium compound. For general use, it is obtained from the solid rock salt, as occurring in mines, or from sea-water by evaporation. It is in colorless transparent cubical crystals, or white crystalline powder, odorless, saline taste, soluble in 2.8 parts water, almost insoluble in alcohol, ether, chloroform, decrepitates when heated, becoming decomposed; contains 96 p. c. of pure salt. *Assay:* 1 Gm. + distilled water q. s. 100 Cc., of this 10 Cc. + few drops potassium chromate T. S., should require 17 Cc.  $\frac{N}{10}$  silver nitrate V. S. to produce permanent red color. *Impurities:* Heavy metals, bromide, iodide. Dose, cathartic,  $\mathfrak{z}\text{ij}$ -4 (8-15 Gm.); emetic,  $\mathfrak{z}\text{ss}$ -1 (15-30 Gm.), in warm water.

PROPERTIES AND USES.—Base of all sodium preparations, stomachic, tonic, anthelmintic, purgative, emetic, condiment, preservative, intermittent fever, hæmoptysis, phthisis, scrofula, diphtheria, dyspepsia, cholera, worms (ascarides), diabetes, albuminuria, to prevent alcoholic intoxication, congestion of the brain, epilepsy, emetic for narcotics and poisons in stomach, nasal catarrh, ulcers, sore mouth, pruritus, insect-sting, toothache, swellings, bruises, rheumatism, salt-bath, stimulant, for headache, uterine pain, eczema, psoriasis.

**Sodii Carbonas Monohydratus. Monohydrated Sodium Carbonate,  $\text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$ .** (Syn., Fr. Carbonate de Soude monohydraté; Ger. Einfachwasserhaltiges Natriumcarbonat.)

FIG. 447.



Sodium carbonate crystal.

*Manufacture:* By crystallizing ordinary sodium carbonate above 35° C. (95° F.), having the advantage of being comparatively stable and non-efflorescent. It is a white, crystalline, granular powder, odorless, strongly alkaline taste, at 100° C. (212° F.) loses water of crystallization (14.52 p. c.), soluble in 2.9 parts water, 8 glycerin, insoluble in alcohol, ether; contains 85 p. c. of pure anhydrous sodium carbonate, corresponding to 99.5 p. c. of crystallized monohydrated salt. *Assay:* 1 Gm. dissolved in distilled water 10 Cc., should require for neutralization 32.3 Cc.  $\frac{N}{2}$  sulphuric acid V. S., using 3 drops methyl-orange T. S. indicator. *Impurities:* Heavy metals, etc. Dose, gr. 5-15 (.3-1 Gm.), in powder or some bitter infusion.

PREPARATIONS.—1. *Liquor Sodæ Chlorinatae*, 6.5 p. c. 2. *Massa Ferri Carbonatis*, 46 p. c.—36 p. c. ferrous carbonate. 3. *Suppositoria Glycerini*,  $\frac{8}{10}$  gr. (.05 Gm.) or sodium stearate  $3\frac{1}{2}$  gr. (.02 Gm.)—6.5 p. c.

PROPERTIES.—Antacid, irritant, diuretic. Similar to bicarbonate, not much used internally, owing to its corrosive and poisonous action (like sodium hydroxide).

USES.—Gallstones, acidity of stomach or intestines, uric acid diathesis (gout), rheumatism, skin diseases, burns, scrofula, whooping-cough, liver congestion, vulvular pruritus, for making other sodium salts.

Poisoning: As for potassium hydroxide. Give fixed oils, acetic acid, vinegar, lemon-juice, demulcents, relieve pain with opium or morphine.

*Allied Salts:*

1. *Sodii Carbonas*. *Sodium Carbonate*,  $\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}$ .—Official 1830–1900. Obtained by several processes: 1. *Leblanc's*: (1)  $2\text{NaCl} + \text{H}_2\text{SO}_4 = \text{Na}_2\text{SO}_4 + 2\text{HCl}$ . (2)  $\text{Na}_2\text{SO}_4 + 4\text{C} + \text{CaCO}_3 + \text{heat} = \text{Na}_2\text{CO}_3 + \text{CaS} + 4\text{CO}$ ; the resulting mass (black-ash) is washed with water, thereby dissolving out the sodium carbonate. 2. *Cryolite*: This mineral is found in Greenland, being the double fluoride of aluminum and sodium. (1)  $\text{Al}_2\text{F}_6\text{NaF} + 6\text{CaCO}_3 + \text{heat} = \text{Al}_2\text{O}_3\cdot 3\text{Na}_2\text{O} + 6\text{CaF}_2 + 6\text{CO}_2$ . (2)  $\text{Al}_2\text{O}_3\cdot 3\text{Na}_2\text{O} + 3\text{CO}_2 + 3\text{H}_2\text{O} = 3\text{Na}_2\text{CO}_3 + 2\text{Al}(\text{OH})_3$ . The sodium aluminate is dissolved out by lixiviation with water, and into this solution  $\text{CO}_2$  is passed, under pressure, which, decomposing, precipitates aluminum hydroxide together with a little  $\text{Na}_2\text{CO}_3$ , while most of the pure  $\text{Na}_2\text{CO}_3$  remains in solution only to be crystallized out. 3. *Solvay's*: (1)  $\text{NaCl} + 2\text{NH}_3 + 2\text{CO}_2 + 2\text{H}_2\text{O}$ , under pressure  $= \text{NaHCO}_3 + \text{NH}_4\text{HCO}_3 + \text{NH}_4\text{Cl}$ . (2)  $\text{NH}_4\text{HCO}_3 + \text{NaCl} = \text{NaHCO}_3 + \text{NH}_4\text{Cl}$ . (3)  $2\text{NaHCO}_3 + \text{heat} = \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ . It is in colorless, monoclinic crystals, odorless, alkaline taste, effloresces, losing one-half of its water of crystallization (31.46 p. c. by weight), becoming a white powder; soluble in 1.6 parts water, 1.02 glycerin, insoluble in alcohol, ether. *Impurities*: Iron, lead, arsenic, aluminum, ammonia, calcium, potassium, sulphates, chlorides, sulphite, hyposulphite, sulphocyanate. Should be kept in well-closed vessels. Dose, gr. 10–30 (.6–2 Gm.).

2. *Sodii Carbonas Exsiccatas*. *Dried Sodium Carbonate*.—Official 1830–1900. Obtained by exposing ordinary sodium carbonate 200 Gm., in broken crystals, for several days to warm air until effloresced and disintegrated; heat at  $45^\circ \text{C}$ . ( $113^\circ \text{F}$ .) until reduced to 100 Gm. It is in loose white powder responding to reactions of monohydrated sodium carbonate. Dose, gr. 5–15 (.3–1 Gm.). Properties and uses of these two salts identical with that of the official salt.

*Sodii Bicarbonas*. *Sodium Bicarbonate*,  $\text{NaHCO}_3$ .—(Syn., Natrium Carbonicum Acidulum, Bicarbonas Sodicus, Sodium Hydrocarbonate, Acid Sodium Carbonate; Fr. Bicarbonate de Soude, Sel digestive de Vichy; Ger. Natrium bicarbonicum, Natriumbicarbonat, Doppeltkohlensaures Natron.)

*Manufacture*:  $1. (\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}) + \text{CO}_2 = 2\text{NaHCO}_3 + 9\text{H}_2\text{O}$ , this is effected readily either in solution or dry.



2. *Solvay's Process*:  $\text{NaCl} + \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O}$ , under pressure  $= \text{NaHCO}_3 + \text{NH}_4\text{Cl}$ . It is a white opaque powder, odorless, cooling alkaline taste, permanent, soluble in 12 parts water, insoluble in alcohol, ether, heat decomposes it into normal carbonate, water, carbon dioxide, losing 36.9 p. c. of its weight; contains 99 p. c. of pure salt. *Assay*: 2 Gm. should require for neutralization 23.7 Cc. normal sulphuric acid V. S., methyl-orange T. S. indicator. *Impurities*: Heavy metals, carbonate, sulphocyanate. Should be kept cool in well-closed vessels. Dose, gr. 5-30 (.3-2 Gm.).

PREPARATIONS.—1. *Trochisci Sodii Bicarbonatis*. Troches of Sodium Bicarbonate. (Syn., Fr. *Tablettes (Pastilles) de Bicarbonate de Soude*, *Pastilles (de Vichy) digestives*; Ger. *Natronpastillen*.)

*Manufacture*: Triturate nutmeg 1 Gm. with sugar 54 to fine powder, add sodium bicarbonate 18, mucilage of tragacanth q. s. 100 troches. Dose, 1-6 troches.

2. *Caffeina Citrata Effervescens*, 57 p. c. 3. *Ferri Carbonas Saccharatus*, 35 p. c. 4. *Lithii Citras Effervescens*, 57 p. c. 5. *Magnesii Sulphas Effervescens*, 40.3 p. c. 6. *Mistura Rhei et Sodæ*, 3.5 p. c. 7. *Potassii Citras Effervescens*, 47.7 p. c. 8. *Pulvis Acetanilidi Compositus*, 20 p. c. 9. *Pulvis Effervescens Compositus*, 40 gr. (2.6 Gm.). 10. *Sodii Phosphas Effervescens*, 47.7 p. c.

*Unoff. Prep.*: *Sodii Citro-tartaras Effervescens* (Br.), 51 p. c.

PROPERTIES.—Antacid, diuretic, slight depressant and sedative.

USES.—Similar to potassium bicarbonate, but more slowly absorbed; dyspepsia, calculus, infantile croup, pneumonia, gravel, suppressed urine, diabetes, acute articular rheumatism, angina, pruritus, tonsillitis, ophthalmia, rhus toxicodendron poisoning, pain from burns, to dissolve diphtheritic membrane.

*Incompatibles*: Acids, acid salts, bismuth subnitrate.

**Sodii Hydroxidum.** Sodium Hydroxide,  $\text{NaOH}$ .—(Syn., Soda, U. S. P. 1890, Sodium Hydrate, Caustic Soda, Soda Caustica, Natrium (Causticum) Hydricum; Fr. *Soude caustique*; Ger. *Natron*, *Ätznatron*.)

*Manufacture*: 1. Let metallic sodium burn on water, and evaporate  $-\text{H}_2\text{O} + \text{Na} = \text{NaOH} + \text{H}$ .

2. Evaporate liquor sodii hydroxidi to dryness, pour into moulds, bottle quickly to prevent deliquescence. It is in dry, white, translucent pencils or fused masses, showing crystalline fracture, odorless, acrid and caustic taste; on exposure rapidly deliquesces, becoming carbonate by absorbing  $\text{CO}_2$  and  $\text{H}_2\text{O}$ , soluble in 1 part water, alcohol; containing 90 p. c. of pure anhydrous salt, and not more than 2 p. c. of other inorganic substances, with the exception of water. *Assay*: Weigh accurately 1 Gm., dissolve in 50 Cc. water, titrate solution with normal sulphuric acid V. S., using methyl-orange T. S. indicator; multiply number Cc. of V. S. consumed by 3.976, divide product by original weight, quotient = p. c. of pure salt ( $\text{NaOH}$ ) present. *Impurities*: Heavy metals, potassium, silicate, organic and insoluble matter. Should be kept in well-stoppered, hard glass bottles, and handled carefully, owing to its escharotic properties. Dose, gr. 1-2 (.06-.13 Gm.), well diluted.

**PREPARATION.**—1. *Liquor Sodii Hydroxidi*. Solution of Sodium Hydroxide. (Syn., *Liquor Sodæ*, U. S. P. 1890, Solution of Sodium Hydrate, *Natrium Hydricum Solution*; Fr. *Soude caustique liquide*, *Lessive des Savonniers*; Ger. *Liquor Natri caustici*, *Ätznatronlauge*.)

**Manufacture:** 5 p. c. Dissolve sodium hydroxide 5.6 Gm. in distilled water q. s. 100 Gm.; contains 5 p. c. of pure salt. It is a clear, colorless, aqueous liquid, odorless, very acrid, caustic taste, strongly alkaline reaction, sp. gr. 1.056. **Assay:** To neutralize 20 Gm. requires 25 Cc. normal sulphuric acid V. S., methyl-orange T. S. indicator (each Cc. of V. S. indicating 0.2 p. c. of absolute salt). Should be kept in green glass bottles, with glass stoppers coated with paraffin or petrolatum. Dose, m5–30 (.3–2 Cc.), well diluted.

**Prep.:** 1. *Fluidextractum Taraxaci*, 5 p. c.

**Unoff. Prep.:** *Liquor Sodii Ethylatis* (Br.), 5 p. c. (sodium hydroxide), + alcohol q. s. 100 Cc.

**PROPERTIES.**—Strong escharotic, destroys tissue like potassium hydroxide, and otherwise just like it only not quite so poisonous.

**Poisoning, Incompatibles:** Same as for potassium hydroxide.

**Sodii Acetas.** Sodium Acetate,  $\text{NaC}_2\text{H}_3\text{O}_2 + 3\text{H}_2\text{O}$ .—(Syn., *Acetas Sodicus* (*Natricus*), *Terra Foliatæ Tartari* (*Crystallisata*); Fr. *Acétate de Soude*; Ger. *Natrium aceticum*, *Natriumacetate*, *Essigsäures Natron*.)

**Manufacture:** Neutralize acetic acid with sodium carbonate or bicarbonate, evaporate, crystallize— $\text{Na}_2\text{CO}_3 + 2\text{HC}_2\text{H}_3\text{O}_2 = 2\text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} + \text{CO}_2$ , or from acetic acid in purifying wood vinegar.

It is in colorless, transparent, monoclinic prisms, or granular crystalline powder, odorless, cooling, saline taste, efflorescent, soluble in 1 part water, 23 alcohol, liquefies at  $60^\circ \text{C}$ . ( $140^\circ \text{F}$ .), at  $123^\circ \text{C}$ . ( $253^\circ \text{F}$ .) becomes anhydrous, dry, at higher temperature gives residue of sodium carbonate and carbon; contains 99.5 p. c. of pure salt. **Assay:** 1 Gm. carbonized, residue extracted with boiling water, should require for neutralization 14.7 Cc.  $\frac{\text{N}}{2}$  sulphuric acid V. S., methyl-orange T. S. indicator. **Impurities:** Heavy metals, arsenic, potassium. Should be kept in well-stoppered bottles.

**PROPERTIES AND USES.**—Diuretic, rarely used in medicine, but to distil with  $\text{H}_2\text{SO}_4$  for acetic acid. Dose, gr. 15–60 (1–4 Gm.).

**Allied Salt:**

1. *Sodii Santoninas*. Sodium Santoninate,  $2\text{NaC}_{15}\text{H}_{19}\text{O}_4 \cdot 7\text{H}_2\text{O}$ .—Official 1880–1890. Obtained by heating solution sodium hydroxide 100 Cc., water 30 Cc., santonin 30 Gm. till all dissolved, filter, crystallize. Is in fine felt-like needle crystals or prisms, inodorous, saline, bitter taste, alkaline reaction; soluble in 3 parts water, 12 alcohol. Should be kept in dark, amber-colored, well-stoppered vials, in the dark. Dose, adults, gr. 5–10 (.3–.6 Gm.), twice daily; children, gr. 1–5 (0.6–.3 Gm.), with sugar.

**PROPERTIES AND USES.**—Anthelmintic, lumbricoid worms.

FIG. 448.



Sodium acetate crystal.

**Sodii Benzoas.** Sodium Benzoate,  $\text{NaC}_7\text{H}_5\text{O}_2$ ; if in crystals,  $\text{NaC}_7\text{H}_5\text{O}_2 \cdot \text{H}_2\text{O}$ .—(Syn., Benzoas Sodicus; Fr. Benzoate de Soude; Ger. Benzoesaures Natron, Natriumbenzoat.)

*Manufacture:* Benzoic acid is added to hot concentrated solution of sodium carbonate (bicarbonate), evaporated, crystallized— $\text{Na}_2\text{CO}_3 + 2\text{HC}_7\text{H}_5\text{O}_2 = 2\text{NaC}_7\text{H}_5\text{O}_2 + \text{H}_2\text{O} + \text{CO}_2$ . It is a white, amorphous granular or crystalline powder, odorless, sweet, astringent taste, permanent; soluble in 1.6 parts water, 43 alcohol, melts emitting vapors having benzoic acid odor, chars into sodium carbonate and carbon; contains 99 p. c. of pure salt. *Assay:* 1 Gm. carbonized, residue extracted with boiling distilled water, should require for neutralization 13.85 Cc.  $\frac{N}{7}$  hydrochloric acid V. S., methyl-orange T. S. indicator. *Impurities:* Heavy metals, etc. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.), ter die.

**PROPERTIES AND USES.**—Similar to benzoic acid, disinfects and renders alkaline urine acid; gout, rheumatism, phthisis, diphtheria, lithæmia, lithæmic gravel, puerperal fever.

**Sodii Bisulphis.** Sodium Bisulphite,  $\text{NaHSO}_3$ .—(Syn., Acid Sodium Sulphite, Bisulphis Sodicus; Fr. Bisulphite de Soude; Ger. Natrium (bisulfit)-bisulphurosum, Doppelschwefligsaures Natron.)

*Manufacture:* Saturate a solution of sodium carbonate or bicarbonate with  $\text{SO}_2$ , allow to crystallize in a cool place— $\text{Na}_2\text{CO}_3 + 2\text{H}_2\text{O} + 2\text{SO}_2 = 2\text{NaHSO}_3 + \text{H}_2\text{O} + \text{CO}_2$ . It is in opaque, prismatic crystals, or granular powder, odor of  $\text{SO}_2$ , taste disagreeable, sulphurous; on exposure loses  $\text{SO}_2$ , becoming oxidized into sulphate; soluble in 3.5 parts water, 70 alcohol, strongly heated decrepitates; contains 90 p. c. of pure salt. *Assay:* Add 0.25 Gm. to 50 Cc.  $\frac{N}{10}$  iodine V. S., let stand 1 hour, shaking frequently, should require to decolorize the solution 6.45 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. *Impurities:* Heavy metals, thiosulphate. Should be kept cool in small, well-filled, well-stoppered bottles. Dose, gr. 5–30 (.3–2 Gm.).

**PROPERTIES AND USES.**—Checks putrefaction, fermentation, yeasty vomiting, aphthous sore throat, to neutralize the chlorine in bleaching fabrics.

FIG. 449.



Sodium thiosulphate crystal.

**Sodii Sulphis.** Sodium Sulphite,  $\text{Na}_2\text{SO}_3 + 7\text{H}_2\text{O}$ .—(Syn., Sulfis Sodicus (Natricus); Fr. Sulphite de Soude; Ger. Natriumsulfit, Schwefligsaures Natron.)

*Manufacture:* Saturate a solution of  $\text{Na}_2\text{CO}_3$  (or  $\text{NaOH}$ ) with  $\text{SO}_2$ , then add sodium carbonate equal to original amount taken, evaporate, crystallize— $\text{Na}_2\text{CO}_3 + \text{SO}_2 = \text{Na}_2\text{SO}_3 + \text{CO}_2$ , or  $2\text{NaHSO}_3 + \text{Na}_2\text{CO}_3 = 2\text{Na}_2\text{SO}_3 + \text{CO}_2 + \text{H}_2\text{O}$ . It is in colorless, transparent, monoclinic prisms, odorless, cooling, saline, sulphurous taste, effloresces, oxidizes to sulphate; soluble in 2 parts water, sparingly in alcohol; contains in uneffloresced and air-dried condition 96 p. c. of

pure salt. *Assay*: Add 0.5 Gm. to 50 Cc.  $\frac{N}{10}$  iodine V. S., let stand 1 hour, shaking at intervals, should require 11.65 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to discharge the color of solution. *Impurities*: Heavy metals, thiosulphate. Should be kept cool, in well-stoppered bottles. Dose, gr. 5–30 (.3–2 Gm.).

**PROPERTIES AND USES.**—Same as the bisulphite. It is one of our most useful antiferments.

**Sodii Thiosulphas.** Sodium Thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3 + 5\text{H}_2\text{O}$ .—(Syn., Sodii Hyposulphis, U. S. P. 1890, Hyposulphis Sodicus; Fr. Hyposulphite de Soude, Sulphite sulfuré de Soude; Ger. Natrium thiosulfuricum, Natriumthiosulfat, Natrium hyposulphurosum (subsulphurosum), Unterschweifsaures Natron.)

*Manufacture*: By boiling solution sodium sulphite with sulphur— $\text{Na}_2\text{SO}_3 + \text{S} = \text{Na}_2\text{S}_2\text{O}_3$ , or boiling  $6\text{NaOH} + \text{S}_{12} = \text{Na}_2\text{S}_2\text{O}_3 + 2\text{Na}_2\text{S}_3 + 3\text{H}_2\text{O}$ , or on larger scale by double decomposition of sodium carbonate with calcium thiosulphate— $\text{Na}_2\text{CO}_3 + \text{CaS}_2\text{O}_3 = \text{Na}_2\text{S}_2\text{O}_3 + \text{CaCO}_3$ . This is not, as sometimes considered, a true hyposulphite ( $\text{NaHSO}_2$ ), which, however, can be made thus:  $3\text{NaHSO}_3 + \text{Zn} = \text{NaHSO}_2 + \text{Na}_2\text{SO}_3 + \text{ZnSO}_3 + \text{H}_2\text{O}$ . It is in colorless, transparent, monoclinic prisms, odorless, cooling, bitter taste, permanent below  $33^\circ \text{C}$ . ( $91.4^\circ \text{F}$ .), efflorescent above that; soluble in 0.35 part water, insoluble in alcohol; contains 98 p. c. of pure salt. *Assay*: 1 Gm. dissolved in water 20 Cc., should require 39.75 Cc.  $\frac{N}{10}$  iodine V. S. to produce slight yellow tint. *Impurities*: Heavy metals, arsenic, calcium, caustic alkalies or carbonates, sulphite, bisulphite, sulphide. Should be kept in well-stoppered bottles. Dose, gr. 5–30 (.3–2 Gm.), also in baths and ointments.

**PROPERTIES AND USES.**—Alterative, resolvent, destructive to fungi, arrests fermentation, pyæmia, zymotic disorders, yeasty vomiting, parasitic affections of the skin and mouth, erysipelas, typhus, typhoid fever, eruptive fevers, yellow fever, diphtheria, purulent infection, intermittent fever, dyspepsia, putrid products, cancers, gangrene, fetid bronchitis, impetigo, sycosis, prurigo pudendi. In the arts, as decolorizing in paper manufacture and in photography to dissolve the unaltered silver chloride or bromide in the film.

**Sodii Hypophosphis.** Sodium Hypophosphite,  $\text{NaH}_2\text{PO}_2 + \text{H}_2\text{O}$ .—(Syn., Hypophosphis Sodicus; Fr. Hypophosphite de Soude; Ger. Natrium hypophosphorosum Unterphosphorigsaures Natron.)

*Manufacture*: Add sodium carbonate to solution of calcium hypophosphite, filter, evaporate, granulate— $\text{Na}_2\text{CO}_3 + \text{Ca}(\text{H}_2\text{PO}_2)_2 = 2\text{NaH}_2\text{PO}_2 + \text{CaCO}_3$ ; should evaporate cautiously to avoid the giving off of inflammable hydrogen phosphide. It occurs in small colorless, transparent, rectangular plates, pearly lustre, or white granular powder, odorless, saline, bitter-sweet taste, deliquescent, soluble in 1 part water, 25 alcohol, insoluble in ether, when heated loses water of crystallization, is decomposed, evolving hydrogen, and hydrogen phosphide which burns spontaneously with yellow flame, residue sodium pyrophosphate, metaphosphate, sometimes little red phosphorus; contains 98 p. c. of

pure salt. *Impurities*: Heavy metals, arsenic, caustic alkali, carbonate. Should be kept in well-stoppered bottles, and dispensed cautiously, as explosion is liable to occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.), *ter die*, in water, syrup, or mixture.

**PREPARATIONS.**—1. *Emulsum Olei Morrhuae cum Hypophosphitibus*,  $\frac{1}{2}$  p. c. 2. *Syrupus Hypophosphitum*, 1.5 p. c. 3. *Syrupus Hypophosphitum Compositum*, 1.75 p. c.

**PROPERTIES AND USES.**—Stimulates the nervous system, aids digestion and nutrition, phthisis, chronic bronchitis, scrofula, syphilis, anæmia, impotence, promotes bone-formation. Generally combined with other hypophosphites, cod-liver oil, etc.

**Sodii Bromidum.** Sodium Bromide, NaBr.—(Syn., Bromuretum Sodicum; Fr. Bromure de Sodium; Ger. Natrium bromatum, Natrium-bromid, Bromnatrium.)

*Manufacture*: Similar to potassium bromide, using sodium hydroxide or sodium carbonate with bromine, or by double decomposition between ferrous bromide and sodium carbonate— $\text{Na}_2\text{CO}_3 + \text{FeBr}_2 = 2\text{NaBr} + \text{FeCO}_3$ . It is in colorless or white cubical crystals or white granular powder, odorless, saline, bitter taste, soluble in 1.7 parts water, 12.5 alcohol, absorbs moisture, melts at red heat, beyond that volatilizes without decomposition; contains, when dry, 97 p. c. of pure salt. *Assay*: Dissolve 0.3 Gm. in 50 Cc. water, + 2–3 drops potassium chromate T. S., should require to produce permanent red color 28.5–30 Cc.  $\frac{N}{10}$  silver nitrate V. S. *Impurities*: Heavy metals, barium, bromate, iodide, alkali. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.), in water, elixir, syrup, or powder.

**PROPERTIES AND USES.**—Similar to those of potassium bromide, but is less irritating to the stomach, and less depressant. Epilepsy, insomnia, delirium tremens, nervous palpitation, nervousness at menopause, sea-sickness.

*Poisoning, Incompatibles, Synergists*: See potassium bromide, page 707.

**Sodii Iodidum.** Sodium Iodide, NaI.—(Syn., Fr. Iodure de Sodium; Ger. Natrium jodatum (jodid), Jodnatrium, Natrium iodatum.)

*Manufacture*: Add iodine to a solution of sodium hydroxide, (or sodium carbonate), or by double decomposition between ferrous iodide and sodium carbonate— $(\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}) + \text{FeI}_2 = 2\text{NaI} + \text{FeCO}_3 + 10\text{H}_2\text{O}$ . It is in colorless, cubical crystals or white crystalline powder, odorless, saline, bitter taste, deliquesces and frequently undergoes decomposition into sodium carbonate and free iodine, soluble in 0.5 part water, 3 alcohol, volatilized and partly decomposed by heat; contains 98 p. c. of pure salt. *Assay*: Dissolve 0.5 Gm. in 10 Cc. distilled water, + 5 drops potassium chromate T. S., should require to produce permanent red color 33–34.6 Cc.  $\frac{N}{10}$  silver nitrate V. S. (corresponding to 98 p. c. of pure salt). *Impurities*: Heavy metals, barium, potassium, free iodine, alkali, cyanide, iodate, thiosulphate, nitrates, nitrites,

Should be kept in well-stoppered bottles. Dose, gr. 2–30 (.13–2 Gm.), ter die, in water, elixir, or syrup.

**PROPERTIES AND USES.**—Same as potassium iodide, only is less depressing and irritating. Constitutional syphilis, chronic eczema; with arsenic in lepra, psoriasis, also as a stimulant and antiseptic in foul ulcers, sores, fetor in general.

*Poisoning, Incompatibles:* See iodine, page 692.

**Sodii Salicylas.** Sodium Salicylate,  $\text{NaC}_7\text{H}_5\text{O}_3$ .—(Syn., Fr. Salicylate de Soude; Ger. Natrium salicylicum, Natriumsalicylat.)

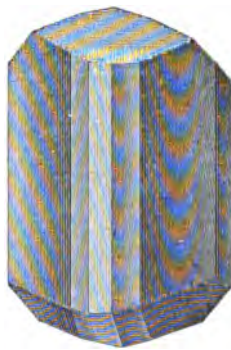
*Manufacture:* Neutralize salicylic acid with sodium carbonate (or bicarbonate), strain, heat to drive off  $\text{CO}_2$ , evaporate— $\text{Na}_2\text{CO}_3 + 2\text{HC}_7\text{H}_5\text{O}_3 = 2\text{NaC}_7\text{H}_5\text{O}_3 + \text{H}_2\text{O} + \text{CO}_2$ ; solution must remain slightly acid, as alkali salicylates, having excess of alkali, absorb oxygen and become colored. It is a white, microcrystalline powder or scales, or an amorphous, colorless powder, or faint pink tinge, odorless, sweetish, saline taste, soluble in 0.8 part water, 5.5 alcohol, glycerin, decomposed by heat, giving off inflammable vapors and phenol odor, residue of sodium carbonate; contains 99.5 p. c. of pure salt. *Assay:* 1 Gm. carbonized, residue extracted with boiling distilled water, should require for neutralization 12.5 Cc. sulphuric acid V. S., using methyl-orange T. S. indicator. *Impurities:* Heavy metals, sulphites. Should be kept dark, cool, in well-stoppered bottles. Dose, gr. 15–30 (1–2 Gm.), ter die, in elixir or water.

**PROPERTIES AND USES.**—Same as salicylic acid (page 466), but not so irritating, and is absorbed more rapidly; it lowers temperature, lessens pain; rheumatism, neuralgia, tonsillitis, dysmenorrhœa, pruritus, whooping-cough, migraine, cholera infantum, diarrhœa, variola, orchitis, rheumatic iritis, biliary colic, acute pleurisy, sciatica, to prevent formation of gallstones, diabetes.

**Sodii Arsenas.** Sodium Arsenate,  $\text{Na}_2\text{HAsO}_4 + 7\text{H}_2\text{O}$ .—(Syn., Sodii Arsenias, Arsenias Natrius (Sodicus), Arseniate (Arsenate) of Soda; Fr. Arséniate de Soude; Ger. Natriumarsenat (arsenicum), Arsensaurus Natron.)

*Manufacture:* Heat arsenic trioxide (10), sodium nitrate (8.5), and dried sodium carbonate (5.5) to redness, dissolve fused mass in water (35), crystallize— $\text{As}_2\text{O}_3 + 2\text{NaNO}_3 + \text{Na}_2\text{CO}_3 = \text{Na}_4\text{As}_2\text{O}_7 + \text{N}_2\text{O}_3 + \text{CO}_2$ . Upon the addition of water to the warm mass, one molecule is combined, thereby converting the sodium pyroarsenate into the orthoarsenate, and as such crystallizes upon standing— $\text{Na}_4\text{As}_2\text{O}_7 + 15\text{H}_2\text{O} = 2(\text{Na}_2\text{HAsO}_4, 7\text{H}_2\text{O})$ . It is in colorless, transparent, monoclinic prisms, odorless, mild alkaline taste, very poisonous, efflorescent in dry air, deliquescent in moist air, soluble in 1.2 parts water, when heated

FIG. 450.



Sodium arsenate crystal.

loses 5 molecules water (28.8 p. c.), becoming white powder, and the pyroarsenate; contains in an uneffloresced condition 98 p. c. of pure disodium-orthoarsenate. Should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.004–.008 Gm.).

**PREPARATIONS.**—1. *Sodii Arsenas Exsiccatus*. Exsiccated Sodium Arsenate. (Syn., Br. Sodii Arsenas, Natrium Arsenicum Exsiccatum, Dried (Anhydrous) Arsenate of Soda; Fr. Arseniate de Soude desséché; Getrocknetes Natriumarsenat.)

**Manufacture:** Break into small fragments sodium arsenate crystals 100 Gm., allow them to effloresce at 40–50° C. (104–122° F.), until disintegrated, heat to 150° C. (302° F.) until product ceases to lose weight, reduce to powder. It is an amorphous, white powder, odorless, mildly alkaline taste, permanent, soluble in 3 parts water, at red heat converted into pyroarsenate; contains 98 p. c. of pure anhydrous salt. **Impurities:** Lead, copper, iron, arsenite, etc. Should be kept in dry, well-stoppered bottles. Dose, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.0025–.005 Gm.).

**Prep.:** 1. *Liquor Sodii Arsenatis*. Solution of Sodium Arsenate. (Syn., Solution of Arseniate of Sodium; Fr. Liqueur (Soluté) d'Arseniate de Soude; Ger. Arsensaure Natronlösung.)

**Manufacture:** 1 p. c. Dissolve exsiccated sodium arsenate 1 Gm. in distilled water q. s. 100 Gm.; this aqueous solution contains sodium arsenate corresponding to 1 p. c. of dried salt, and while it is a substitute for Pearson's Solution, the latter, it should be remembered, is only one-tenth as strong as the official liquor. Dose, Mij–6 (.2–.4 Cc.), diluted.

**PROPERTIES AND USES.**—Similar to arsenic trioxide. Liquor—identical with liquor potassii arsenitis in strength, but is said to cause poisoning less easily and does not irritate stomach so readily. Used in same diseases as arsenic trioxide—neuralgia, chronic malaria, nervous debility, chorea, eczema, anæmia, etc.

**Poisoning:** Same as for arsenic trioxide.

**Sodii Chloras.** **Sodium Chlorate**,  $\text{NaClO}_3$ .—(Syn., Chloras Sodicus; Fr. Chlorate de Soude; Ger. Natrium chloratum (chloricum), Natriumchlorid.)

FIG. 451.



Sodium chlorate crystal.

**Manufacture:** Make sodium bitartrate by adding crystals of sodium carbonate 9 parts to tartaric acid 9.5 parts in solution, now add this hot solution to one containing potassium chlorate 8 parts—(1)  $\text{Na}_2\text{CO}_3 + 2\text{H}_2\text{C}_4\text{H}_4\text{O}_6 = 2\text{NaHC}_4\text{H}_4\text{O}_6 + \text{H}_2\text{O} + \text{CO}_2$ . (2)  $\text{NaHC}_4\text{H}_4\text{O}_6 + \text{KClO}_3 = \text{NaClO}_3 + \text{KHC}_4\text{H}_4\text{O}_6$ . It is in colorless, transparent crystals (regular cubes with tetrahedral facets) or a crystalline powder, odorless, cooling, saline taste, permanent, soluble in 1 part water, 5 glycerin, 100 alcohol, melts when heated, giving off oxygen (45 p. c. of its weight), leaving residue of sodium chloride; contains 99 p. c. of pure salt. **Impurities:** Lead, copper, potassium, etc. Should be kept in well-stoppered bottles, and handled cautiously, as dangerous explosions may occur if heated,

subjected to concussion or trituration with organic substances (cork, tannin, sugar, sulphur, antimony sulphide, phosphorus, gambir, catechu, glycerin, etc.). Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Same as potassium chlorate, but is more soluble, hence may be used in more concentrated solution.

**Sodii Phosphas.** **Sodium Phosphate**,  $\text{Na}_2\text{HPO}_4 + 12\text{H}_2\text{O}$ .—(Syn., Sodium Orthophosphate, Phosphas Sodicus (Natricus), Disodium Hydrogen Phosphate; Fr. Phosphate de Soude; Ger. Natrium phosphoricum, Natriumphosphat, Phosphorsaures Natron.)

**Manufacture:** Digest bone-ash with  $\text{H}_2\text{SO}_4$ , which forms acid calcium phosphate —  $\text{Ca}_3(\text{PO}_4)_2 + 2\text{H}_2\text{SO}_4 = \text{Ca}(\text{H}_2\text{PO}_4)_2 + 2\text{CaSO}_4$ ; filter, heat, add sodium carbonate to the solution, evaporate filtrate, crystallize —  $\text{Ca}(\text{H}_2\text{PO}_4)_2 + 2\text{Na}_2\text{CO}_3 = 2\text{Na}_2\text{HPO}_4 + \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2$ . It is in large, colorless, monoclinic prisms or granular, crystalline salt, odorless, cooling, saline taste, efflorescent, gradually loses 5 molecules water of crystallization (25.1 p. c.), and all at  $100^\circ \text{C}$ . ( $212^\circ \text{F}$ .) (60.3 p. c.), soluble in 5.5 parts water, insoluble in alcohol; contains in an uneffloresced condition 99 p. c. of pure disodium-orthophosphate. **Impurities:** Heavy metals, arsenic, calcium, carbonate. Should be kept cool, in well-stoppered bottles. Dose, alterative, gr. 20–40 (1.3–2.6 Gm.); purgative, ʒij–6 (8–24 Gm.).

**PREPARATIONS.**—1. *Sodii Phosphas Exsiccatus*. Exsiccated Sodium Phosphate. (Syn., Natrium Phosphoricum Exsiccatum, Dried (Anhydrous) Sodium Phosphate; Fr. Phosphate de Soude desséché; Ger. Getrocknetes Natriumphosphat.)

**Manufacture:** Allow sodium phosphate crystals 100 Gm. to effloresce several days in warm air at  $25$ – $30^\circ \text{C}$ . ( $77$ – $86^\circ \text{F}$ .), continue the drying in an oven, gradually increasing the heat to  $100^\circ \text{C}$ . ( $212^\circ \text{F}$ .), until salt ceases to lose weight; powder and sift. It is a white powder which absorbs moisture readily; contains 99 p. c. of pure anhydrous salt. Should be kept in well-stoppered bottles. Dose, gr. 10–60 (.6–4 Gm.).

**Prep.:** 1. *Sodii Phosphas Effervescens*. Effervescent Sodium Phosphate. (Syn., Natrium Phosphoricum Effervescens; Fr. Phosphate de Soude Effervescent; Ger. Brausendes Natriumphosphat.)

**Manufacture:** Mix powdered citric acid 16.2 Gm., with exsiccated sodium phosphate 20, tartaric acid 25.2, then incorporate sodium bicarbonate 47.7; heat in an oven at  $93$ – $104^\circ \text{C}$ . ( $199$ – $219^\circ \text{F}$ .); when mixture moist from careful manipulation with wooden spatula, rub through No. 6 tinned-iron sieve, dry granules. Should be kept in well-stoppered bottles. Dose, ʒj–4 (4–15 Gm.).

2. *Liquor Sodii Phosphatis Compositus*. Compound Solution of Sodium Phosphate. (Syn., Fr. Soluté de Phosphate de Soude composé; Ger. Zusammengesetzte Natriumphosphatlösung.)

**Manufacture:** Triturate together sodium phosphate, crystals, 100 Gm., sodium nitrate 4, citric acid 13, until liquefied, add distilled water q. s.



100 Cc., filter. *Tests*: 1. Dilute 1 Cc. with water 1 Cc., + slight excess ammonia water, + 1 Cc. magnesia mixture T. S., get white crystalline precipitate. 2. 1 Cc. + 5 Cc. water + equal volume sulphuric acid, cool, + ferrous sulphate crystal, get dark brown zone around crystal. Should be kept moderately warm, in well-stoppered bottles. Dose, ʒj-2 (4-8 Cc.), in water (hot) 1 hour before meals.

**PROPERTIES AND USES.**—Hepatic stimulant, mild purgative, alterative, scrofula, rachitis, diabetes, scrofulous ophthalmia, bowel complaint, diarrhoea, jaundice, fevers.

**Sodii Pyrophosphas.** **Sodium Pyrophosphate**,  $\text{Na}_4\text{P}_2\text{O}_7 + 10\text{H}_2\text{O}$ .—(Syn., Pyrophosphas Sodicus; Fr. Pyrophosphate de Soude; Ger. Natrium (pyrophosphoricum)-pyrophosphat.)

*Manufacture*: Heat sodium phosphate to dull redness— $2(\text{Na}_2\text{HPO}_4 + 12\text{H}_2\text{O}) = \text{Na}_4\text{P}_2\text{O}_7 + 25\text{H}_2\text{O}$ . It is in colorless, transparent, monoclinic prisms, or crystalline powder, odorless, cooling, saline, feebly alkaline taste, efflorescent in warm air, soluble in 11.5 parts water, insoluble in alcohol, at 100° C. (212° F.) loses its water of crystallization (40.35 p. c.); contains in an uneffloresced condition 99 p. c. of pure salt. *Impurities*: Heavy metals, arsenic, carbonate, ortho-phosphate. Dose, ʒj-4 (4-15 Gm.).

**PROPERTIES AND USES.**—Same as phosphate.

**Sodii Sulphas.** **Sodium Sulphate**,  $\text{Na}_2\text{SO}_4 + 10\text{H}_2\text{O}$ .—(Syn., Glauber's Salt, Sulfas Sodicus (Natricus); Fr. Sulfate de Soude, Sel de Glauber; Ger. Natrium sulfuricum, Natriumsulfat, Glaubersalz.)

*Manufacture*: As a by-product in making soda-ash, hydrochloric acid, nitric acid, ammonium chloride, carbonated waters, etc.; neutralize residue thus left with sodium carbonate, filter, evaporate, crystallize— $2\text{NaHSO}_4 + \text{Na}_2\text{CO}_3 = 2\text{Na}_2\text{SO}_4 + \text{CO}_2 + \text{H}_2\text{O}$ . It is in large, colorless, transparent, monoclinic prisms, or granular crystals, odorless, bitter, saline taste, efflorescent, finally losing all water of crystallization; soluble in glycerin, 2.8 parts water, insoluble in alcohol, readily fuses, at 100° C. (212° F.) loses all water of crystallization (55.9 p. c.), without decomposition; contains in uneffloresced condition 99 p. c. of pure salt. *Impurities*: Heavy metals, arsenic. Should be kept cool, in well-closed vessels. Dose, purgative, ʒij-8 (8-30 Gm.).

**PROPERTIES AND USES.**—Hydragogue cathartic, diuretic; the strongest sodium purgative. When effloresced (dehydrated) it is twice as strong, hence dose should be only one-half. Largely used in veterinary practice, but for man is so harsh that magnesium sulphate is almost always substituted. Used in constipation, plethora, typhoid fever, dysentery, gastric ulcers, to neutralize phenol (carbolic acid) corrosion, to make sodium carbonate and glass. The bitter, nauseous taste may be overcome by flavoring with aromatic syrup, lemon, etc.

**Sodii Phenolsulphonas.** **Sodium Phenolsulphonate**,  $\text{NaC}_6\text{H}_4\text{O}_3\text{S} + 2\text{H}_2\text{O}$ .—(Syn., Sodii Sulphocarbolas, Sodium Sulphocarbonate, Para-

phenol-sulphonate; Fr. Sulphophénate de Soude; Ger. Phenolsulphosaures Natrium.)

*Manufacture:* Heat equal weights of sulphuric acid and crystallized phenol (carbolic acid) for several days at  $55^{\circ}$  C. ( $131^{\circ}$  F.); this forms paraphenolsulphonic acid (sulphocarbolic acid), which yields clear solution with 20 parts water— $C_6H_5OH + H_2SO_4 = HSO_3C_6H_4OH + H_2O$ ; to this add gradually barium carbonate 2 parts until effervescence ceases— $2HSO_3C_6H_4OH + BaCO_3 = Ba(SO_3C_6H_4(OH))_2 + H_2O + CO_2$ . The  $BaSO_4$  deposits, liquid is filtered, and the barium phenolsulphonate is decomposed with sodium carbonate solution— $Ba(SO_3C_6H_4(OH))_2 + Na_2CO_3 = 2NaSO_3C_6H_4(OH) + BaCO_3$ ; evaporate, crystallize. It is in colorless, transparent, rhombic prisms, odorless, cooling, saline, bitter taste, efflorescent in dry air, soluble in 4.8 parts water, 130 alcohol, heated slightly above  $100^{\circ}$  C. ( $212^{\circ}$  F.) loses water of crystallization (15.5 p. c.), becoming white, at higher temperature emits inflammable vapors of phenol odor, leaving residue of sodium sulphate (30.6 p. c.); contains 99 p. c. of pure salt. *Impurities:* Heavy metals, etc. Should be kept in well-stoppered bottles. Dose, gr. 3–15 (.2–1 Gm.); mostly in injection, spray, etc.

**PROPERTIES AND USES.**—Antiferment, phthisis, typhoid fever, eruptive fevers, scarlatina, fermentation, dyspepsia, diarrhoea, gangrene, diphtheria, thrush, vomiting in pregnancy.

## LITHIUM.

$$L^1 = 7.$$

The metal lithium (Gr. *λίθος*, a stone—*i. e.*, dissolves these in the system, or is found among minerals) is not official, but has several salts which are. It is found sparingly as silicate in a few rare minerals, lepidolite, spodumene, amblygonite, etc., as chloride in soils and spring waters, and as carbonate in plant ashes; it is the lightest metal known, resembles potassium and sodium, and, like them, ignites when thrown upon water.

*Tests for Lithium Salts.*—1. The volatile salts give a vivid red to colorless flame. 2. Lithium compounds in strong solutions give with ammonium carbonate a white precipitate. 3. The neutral or alkaline solutions give with sodium phosphate, on boiling, a white precipitate ( $Li_3PO_4$ ), soluble in acids and ammonium salts.

**Lithii Carbonas.** Lithium Carbonate,  $Li_2CO_3$ .—(Syn., Carbonas Lithicus; Fr. Carbonate (de Lithine) lithique; Ger. Lithium carbonicum, Lithiumcarbonat, Lithiæ Carbonas, Kohlensaures Lithion.)

*Manufacture:* 1. By double decomposition between lithium chloride and ammonium carbonate, filtering, washing with alcohol, drying— $2LiCl + NH_4HCO_3 = Li_2CO_3 + NH_4Cl + HCl$ .

2. Fuse together lepidolite 10 parts, barium carbonate 10, barium sulphate 5, potassium sulphate 3. The heavy barium silicate and sul-

phate subside, while lithium and potassium sulphates come to the surface, the mass is now lixiviated to dissolve the two latter salts, and then by double decomposition with ammonium carbonate we get lithium carbonate. It is a light white powder, odorless, alkaline taste, permanent; soluble in 75 parts water, in diluted acids with active effervescence, insoluble in alcohol, fuses at red heat, beyond that loses carbon dioxide, becoming lithium oxide, solution in hydrochloric acid imparts crimson color to flame; contains 98.5 p. c. of pure salt. *Assay*: 0.5 Gm. dissolved in 20 Cc. normal sulphuric acid V. S., should require for neutralization 6.6 Cc. normal potassium hydroxide V. S., using methyl-orange T. S. indicator. *Impurities*: Heavy metals, iron, aluminum, other alkalis. Should be kept in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), in carbonic-acid water.

**PROPERTIES AND USES.**—Diuretic to remove uric acid calculi, gout, gouty diathesis, to dissolve false membrane. Best solvent for uric acid, slight depressant, renders urine alkaline.

**Lithii Benzoas.** Lithium Benzoate,  $\text{LiC}_7\text{H}_5\text{O}_2$ .—(Syn., Benzoas Lithicus; Fr. Benzoate de (Lithine) Lithium; Ger. Benzoësaures Lithion, Lithium [benzoat] benzoicum.)

*Manufacture*: Add benzoic acid to hot solution of lithium carbonate, evaporate, crystallize— $2\text{HC}_7\text{H}_5\text{O}_2 + \text{Li}_2\text{CO}_3 + \text{boiling in water} = 2\text{LiC}_7\text{H}_5\text{O}_2 + \text{H}_2\text{O} + \text{CO}_2$ . It is a light white powder, or in shining crystalline scales, faint benzoin odor, cooling, sweetish taste, permanent; soluble in 3 parts water, 13 alcohol, fuses when heated, giving residue of lithium carbonate mixed with carbon; contains 98.5 p. c. of pure salt. *Test*: 1. 0.5 Gm. + anhydrous ammonium sulphate, 1 Gm., cautiously ignited, residue should weigh 0.210–0.216 Gm. *Impurities*: Heavy metals, iron, aluminum, other alkalis. Should be kept in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Diuretic in gout, etc., but no better than citrate and carbonate. Calculous disorders, rheumatism.

**Lithii Bromidum.** Lithium Bromide,  $\text{LiBr}$ .—(Syn., Bromuretum Lithicum; Fr. Bromure de Lithium; Ger. Bromlithium, Lithium [bromid] bromatum.)

*Manufacture*: Heat solution of ferrous bromide with lithium carbonate, evaporate, crystallize— $\text{FeBr}_2 + \text{Li}_2\text{CO}_3 = 2\text{LiBr} + \text{FeCO}_3$ , or can dissolve lithium carbonate in hydrobromic acid. It is a white, granular salt, odorless, sharp, slightly bitter taste, very deliquescent, soluble in alcohol, ether, 0.6 part water, volatile; contains 97 p. c. of pure salt. *Assay*: 1 Gm. + water q. s. 100 Cc., of this 20 Cc. + 2 drops potassium chromate T. S. requires 22.5–23.9 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to produce permanent red color. *Impurities*: Heavy metals, iron, aluminum, potassium, iodine, other alkalis. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).

**PROPERTIES AND USES.**—This is the most hypnotic of all the bromides—epilepsy, gout, etc.

**Lithii Citras.** Lithium Citrate,  $\text{Li}_3\text{C}_6\text{H}_5\text{O}_7 + 4\text{H}_2\text{O}$ .—(Syn., Lithium Citricum; Fr. Citrate de Lithine; Ger. Citron(en)saures (Lithium) Lithion, Lithium [citrat] citricum.)

*Manufacture:* Neutralize solution of citric acid with lithium carbonate, evaporate, crystallize— $3\text{Li}_2\text{CO}_3 + 2\text{H}_3\text{C}_6\text{H}_5\text{O}_7 + \text{H}_2\text{O} + \text{boiling in water} = 2\text{Li}_3\text{C}_6\text{H}_5\text{O}_7 + 4\text{H}_2\text{O} + 3\text{CO}_2$ . It is a white powder, or colorless crystals, odorless, cooling, faintly alkaline taste, deliquescent, soluble in 2 parts water, almost insoluble in alcohol, ether, at red heat chars, emitting inflammable vapors of pungent odor, leaving black residue of lithium carbonate mixed with carbon; contains 98.5 p. c. of pure salt. *Assay:* 0.5 Gm. ignited, cooled, residue moistened with few drops each of nitric and sulphuric acids, again ignited, and repeated until residue white and constant, this lithium sulphate should weigh 0.387–0.394 Gm. *Impurities:* Heavy metals, iron, aluminum, alkalies, etc. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).

**PREPARATION.**—1. *Lithii Citras Effervescens.* Effervescent Lithium Citrate. (Syn., Fr. Limonade, Sèche au Citrate de Lithine; Ger. Brauselithioncitrat.)

*Manufacture:* Triturate citric acid 19.5 Gm. with lithium citrate 5 Gm. and tartaric acid 30, incorporate sodium bicarbonate 57, heat in oven at 93–104° C. (199–219° F.); when manipulated with wooden spatula until moist, rub through No. 6 tinned-iron sieve, dry at 54° C. (129° F.). Should be kept in well-stoppered bottles. Dose, ʒj–2 (4–8 Gm.), in water, drink while effervescing, as it is thus rendered more palatable.

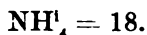
**PROPERTIES AND USES.**—Same as lithium carbonate, being eliminated by the kidneys as such, and has a more pleasant taste, is more soluble and less irritating to the stomach.

**Lithii Salicylas.** Lithium Salicylate,  $\text{LiC}_7\text{H}_5\text{O}_3$ .—(Syn., Fr. Salicylate de Lithine; Ger. Lithiumsalicylicum, Lithiumsalicylat.)

*Manufacture:* Heat salicylic acid (44), lithium carbonate (12) in water (100) until effervescence ceases, filter, evaporate— $\text{Li}_2\text{CO}_3 + 2\text{HC}_7\text{H}_5\text{O}_3 = 2\text{LiC}_7\text{H}_5\text{O}_3 + \text{H}_2\text{O} + \text{CO}_2$ . It is a white or grayish-white powder, odorless, sweetish taste, deliquescent, soluble in water, alcohol, decomposed by heat emitting phenol odor, leaving residue of lithium carbonate and carbon; contains 98.5 p. c. of pure salt. *Assay:* 0.5 Gm. + 1 Gm. powdered anhydrous ammonium sulphate, cautiously ignited gives residue weighing 0.188–0.192 Gm. *Impurities:* Heavy metals, iron, aluminum, other alkalies. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.), in aromatic syrup.

**PROPERTIES AND USES.**—Rheumatism, gout. Better than sodium salicylate or salicylic acid, this latter being less soluble and more of an irritant to the stomach.

## AMMONIUM.



There is no metallic ammonium (L. *Ammoni-a + um*, fr. (*sal*) *ammoniac*, obtained from near temple of Jupiter Ammon, in Libya, by burning camels' dung); the nearest approach to it, so far, being the ammonium amalgam or alloy made by dissolving potassium in mercury, and adding a strong solution of ammonium chloride, when potassium chloride and ammonium amalgam are formed, this latter being a soft spongy metallic substance readily decomposing into mercury, hydrogen, and ammonia gas.

Although we have not the metal as represented in these elements thus joined, we nevertheless have many salts consisting of  $\text{NH}_4$  in combination with various acids, all of which by physical and chemical properties resemble those of potassium, sodium, and lithium.

*Tests for Ammonium Salts:* 1. All compounds evolve ammonia gas when heated with calcium, potassium, or sodium hydroxide; the gas is recognized by odor, by restoring reddened litmus-paper, by dark-blue with cupric sulphate paper. 2. With platinic chloride + HCl get yellow precipitate. 3. Salts are white, volatile, and soluble in water. 4. In neutral solutions cobaltic nitrite gives yellow precipitate.

**Ammonii Benzoas.** **Ammonium Benzoate**,  $\text{NH}_4\text{C}_7\text{H}_5\text{O}_2$ .—(Syn., Ammonium Benzoicum. Ammoniae Benzoas, Benzoas Ammonicus; Fr. Benzoate d'Ammoniaque; Ger. Benzoësaures Ammon.)

*Manufacture:* Dissolve benzoic acid in 20 p. c. ammonia water by warming, stirring, keeping solution always alkaline, set aside to crystallize— $\text{NH}_4\text{OH} + \text{HC}_7\text{H}_5\text{O}_2 = \text{NH}_4\text{C}_7\text{H}_5\text{O}_2 + \text{H}_2\text{O}$ . It is in thin, white, laminar crystals or crystalline powder, odorless or slight odor of benzoic acid, saline, bitter, acrid taste; loses ammonia on exposure, soluble in 10.5 parts water, 25 alcohol, fuses at  $194^\circ \text{C}$ . ( $381^\circ \text{F}$ .) with decomposition (ammonia and benzoic acid), no residue; contains 98 p. c. of pure salt. *Impurities:* Heavy metals, chloride, sulphate. Should be kept in well-stoppered bottles. Dose, gr. 5–30 (.3–2 Gm.), best given in mixture.

**PROPERTIES AND USES.**—Stimulant, diuretic, alterative. Due to the benzoic acid, which is absorbed and eliminated by the kidneys as hippuric acid—the ammonia base as nitric acid; for defective action, solvent for phosphatic deposits (phosphaturia), cystitis, gouty affections, uric acid gravel, muscular rheumatism.

*Incompatibles:* Acids, ferric salts, solution potassium hydroxide.

**Ammonii Bromidum.** **Ammonium Bromide**,  $\text{NH}_4\text{Br}$ .—(Syn., Fr. Bromure d'Ammonium; Ger. Ammonium bromatum, Ammoniumbromid, Bromammonium.)

*Manufacture:* 1. Neutralize hydrobromic acid with ammonia water or carbonate, evaporate, crystallize— $\text{HBr} + \text{NH}_4\text{OH} = \text{NH}_4\text{Br} +$

$\text{H}_2\text{O}$ . 2.  $2\text{NH}_4\text{OH} + \text{FeBr}_2 = 2\text{NH}_4\text{Br} + \text{Fe}(\text{OH})_2$ . 3.  $(\text{NH}_4)_2\text{SO}_4 + 2\text{KBr} = 2\text{NH}_4\text{Br} + \text{K}_2\text{SO}_4$ ; this last method is the best. It is in colorless, transparent, prismatic crystals, or white crystalline powder, odorless, pungent saline taste, permanent, soluble in 1.2 parts water, 12.5 alcohol, volatilizes without fusing; contains 97 p. c. of pure salt. *Impurities*: Heavy metals (iron, etc.), barium, bromate, iodide. Should be kept in well-stoppered bottles. Dose, gr. 5–30 (.3–2 Gm.), ter die.

**PROPERTIES AND USES.**—Like potassium bromide, but less depressing upon the arteries and muscles. Epilepsy, neurosis, delirium tremens, whooping-cough, rheumatism, menorrhagia.

*Incompatibles*: Acids, acid salts, spirit of nitrous ether.

**Ammonii Valeras. Ammonium Valerate**,  $\text{NH}_4\text{C}_5\text{H}_9\text{O}_2$ .—(Syn., Ammonii Valerianas, Ammonium Valerianate, U. S. P. 1890; Fr. Valérianate d'Ammoniaque; Ger. Baldriansaures (Valeriansaures) Ammon, Valerianas Ammonicus.)

*Manufacture*: Saturate valeric acid with ammonia gas—i. e., pass gas into solution of the acid until it is neutral, crystallize. It is in white quadrangular plates, odor of valeric acid, sharp, sweetish taste, deliquescent, soluble in water, alcohol, ether, fuses, giving off ammonia vapor and valeric acid; contains 98 p. c. of pure salt. *Impurities*: Heavy metals, acetate. Dose, gr. 2–10 (.13–.6 Gm.).

**PROPERTIES AND USES.**—Hysteria, epilepsy, chorea, neuralgia, nervous headache, insomnia, heart palpitation.

*Allied Salt*:

1. **Ammonii Phosphas. Ammonium Phosphate**,  $(\text{NH}_4)_2\text{HPO}_4$ .—Official 1880–1890. Obtained by adding strong solution of ammonia to diluted phosphoric acid until alkaline; evaporate, adding ammonia water occasionally to preserve alkalinity; dry crystals quickly. It is in transparent, colorless, monoclinic prisms, sp. gr. 1.678, odorless, cooling, saline taste, efflorescent, soluble in 4 parts water, volatile. Dose, gr. 10–20 (.6–1.3 Gm.), ter die.

**PROPERTIES AND USES.**—Gout, rheumatism, diabetes.

**Ammonii Chloridum. Ammonium Chloride**,  $\text{NH}_4\text{Cl}$ .—(Syn., Muriate of Ammonia, Ammonium (Muriaticum) Hydrochloratum Depuratum, Sal (Ammoniacum) Ammoniac, Chloruretum Ammonicum; Fr. Chlorure d'Ammonium, Sel Ammoniac, Chlorhydrate d'Ammoniaque; Ger. Ammonium Chloratum, Ammoniumchlorid, Reiner Salmiak, Chlorammonium.)

*Manufacture*: The gas-liquor, an aqueous liquid condensed in the preparation and purification of illuminating gas from coal, contains chiefly ammonium carbonate, also sulphide, cyanide, and empyreumatic products; this liquor is distilled with lime and the generated ammonia gas passed into sulphuric acid, forming ammonium sulphate, which is then sublimed with sodium chloride— $(\text{NH}_4)_2\text{SO}_4 + 2\text{NaCl} = \text{Na}_2\text{SO}_4 + 2\text{NH}_4\text{Cl}$ , or the ammonia gas may be passed directly into hydrochloric acid, forming the chloride. It is in white, crystalline powder,

odorless, saline taste, permanent, soluble in 2 parts water, 50 alcohol, 5 glycerin, volatile, heated with potassium hydroxide T. S. evolves ammonia; contains 99.5 p. c. of pure salt. *Assay*: 1 Gm. dissolved in distilled water q. s. 100 Cc.; 10 Cc. of this + 5 drops potassium chromate T. S. should require 18.73 Cc.  $\frac{N}{10}$  silver nitrate V. S. to produce permanent red color. *Impurities*: Heavy metals (iron, etc.), barium, calcium, sulphate, sulphocyanate, empyreumatic, non-volatile substances. Dose, gr. 3–20 (.2–1.3 Gm.).

**PREPARATIONS.**—1. *Trochisci Ammonii Chloridi*. Troches of Ammonium Chloride. (Syn., Fr. Tablettes (Pastilles) de Chlorure d'Ammonium (de Sel Ammoniac); Ger. Salmiakpastillen.)

*Manufacture*: Rub until mixed, ammonium chloride 10 Gm., extract of glycyrrhiza 20, tragacanth 2, sugar 40, form into mass with syrup of tolu q. s. 100 troches. Dose, 1–5 troches.

**PROPERTIES AND USES.**—Stimulant, irritant, expectorant, acute and chronic bronchitis, catarrhal pneumonia, jaundice, hepatic torpor and engorgement, glandular enlargements, hemicrania, dysmenorrhœa, ovaralgia, sciatica, prostate enlargement, amenorrhœa, uterine tumors, stomach hemorrhage, diabetes, rheumatism, snake-bites, contusions, tumors, ulcers, leucorrhœa, gonorrhœa, gangrene, chronic catarrh; in gargles, dentifrices, errhine powders; disagreeable taste may be disguised by elixir, syrup, or fluidextract of licorice.

*Incompatibles*: Cardiac depressants, alkalies, alkaline earths and their carbonates, tartaric and mineral acids, soluble lead and silver salts.

*Synergists*: Expectorants, emetics, diaphoretics.

*Allied Salt*:

1. *Ammonii Sulphas*. *Ammonium Sulphate*,  $(NH_4)_2SO_4$ .—Official 1870–1890. Obtained from coal-gas liquor by mixing it with lime, distilling off ammonia, catching it in sulphuric acid; usually contains sulphocyanate,  $NH_4CNS$ , etc.; a pure salt is prepared by neutralizing diluted sulphuric acid with ammonia water, crystallizing. It is in colorless, transparent, rhombic prisms, odorless, sharp, saline, bitterish taste, permanent, soluble in 1.3 parts water, slightly in alcohol, decomposed by heat. *Impurities*: Iron, lead, chloride, sulphocyanate.

**USES.**—Not used itself in medicine, but in the manufacture of ammonia water, ammonium chloride, ammonia alum, and sulphate of iron and ammonium.

**Ammonii Carbonas**. *Ammonium Carbonate*,  $NH_4HCO_3, NH_4NH_2CO_2$ .—(Syn., Ammoniae Sesquicarbonas, Carbonas Ammonicus, Volatile Salt, Sal Volatile (Siccum), Alkali Volatile; Fr. Sel volatile d'Angleterre, Alkali volatil concret, Carbonate d'Ammoniaque; Ger. Ammonium carbonicum, Ammoniumcarbonat, Kohlensaures Ammonium, Flüchtigtes Laugensalz, Reines Hirschhornsalz.)

*Manufacture*: Heat to redness (sublime) 1 part ammonium chloride (sal ammoniac) + 2 calcium carbonate (chalk), or 4 parts each ammonium sulphate and chalk + 1 charcoal, passing vapors into leaden chambers to condense— $4NH_4Cl + 2CaCO_3 = NH_4HCO_3, NH_4NH_2CO_2$ ,

+  $2\text{CaCl}_2 + \text{NH}_3 + \text{H}_2\text{O}$ ; the ammonia is utilized by passing it into water or dilute sulphuric acid, and ammonia sulphate is used mostly on account of cheapness. This carbonate is not normal,  $(\text{NH}_4)_2\text{CO}_3$ , but is a double salt, one molecule being acid or bi-ammonium carbonate, and one being ammonium carbamate (carbonate deprived of  $\text{H}_2\text{O}$ ); the latter dissolved in water soon becomes neutral ammonium carbonate— $\text{NH}_4\text{NH}_2\text{CO}_2 + \text{H}_2\text{O} = (\text{NH}_4)_2\text{CO}_3$ . If exposed to air, gradually loses ammonia and carbon dioxide, becoming an opaque white powder of acid or bi-ammonium carbonate,  $\text{NH}_4\text{HCO}_3$ . The salt may also be obtained by washing the powdered official carbonate with a little cold water, which dissolves mainly the carbamate, leaving the bicarbonate undissolved. It is in white, hard, translucent, striated masses, strong odor of ammonia without empyreuma, sharp, saline taste, soluble in 4 parts water, decomposed by hot water with elimination of carbon dioxide and ammonia, alcohol dissolves the carbamate,  $\text{NH}_4\text{NH}_2\text{CO}_2$ , but not the acid or bi-ammonium carbonate,  $\text{NH}_4\text{HCO}_3$ , volatile; contains 97 p. c. of mixed salts, and should yield 31.58 p. c. of ammonia gas. *Assay*: 2 Gm. dissolved in 50 Cc. distilled water + 50 Cc. normal sulphuric acid V. S., boiled to expel  $\text{CO}_2$ , cooled, should require for neutralization 12.7 Cc. normal potassium hydroxide V. S., using litmus T. S. indicator. *Impurities*: Heavy metals, chloride, sulphate, thio-sulphate, empyreumatic, non-volatile matters. Should be kept cool, in well-stoppered bottles, and in dispensing only transparent portions should be used. Dose, stimulant, expectorant, gr. 2–3 (.13–.2 Gm.); for fevers, gr. 5–15 (.3–1 Gm.), in solution.

**PREPARATIONS.**—1. *Liquor Ammonii Acetatis*. Solution of Ammonium Acetate. (Syn., Spirit of Mindererus; Fr. Acétate d'Ammoniaque liquide, Esprit de Mindérerus; Ger. Liquor Ammonii acetici, Ammoniumacetatlösung.) An aqueous solution containing 7 p. c. of ammonium acetate,  $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ , with small amounts of acetic and carbonic acids.

*Manufacture*: Add ammonium carbonate (free from white, pulverulent bicarbonate) 5 Gm. to diluted acetic acid 100 Cc., stir until dissolved. It is a clear colorless liquid, free from empyreuma, mildly saline, acidulous taste, acid reaction, no residue. *Tests*: 1. Heated with potassium hydroxide T. S. gives off ammonia; add to 5 Cc., sulphuric acid and alcohol each 1 Cc., boil, get odor of acetic ether; should be freshly made when wanted. Dose,  $\text{ʒij}$ –4 (8–15 Cc.).

*Prep.*: 1. *Liquor Ferri et Ammonii Acetatis*, 50 p. c.

2. *Elixir Ferri, Quininae et Strychninae Phosphatum*,  $\frac{9}{10}$  p. c. 3. *Spiritus Ammoniae Aromaticus*, 3.4 p. c.

*Unoff. Prep.*: *Liquor Ammonii Citratis* (Br.), 8.75 p. c., dose,  $\text{ʒij}$ –6 (8–24 Cc.).

**PROPERTIES AND USES.**—Cardiac stimulant, expectorant, rubefacient, irritant poison; pneumonia, bronchitis, phthisis, hysteria, syncope, typhus and typhoid fevers, scarlatina, measles, erysipelas, bites of venomous serpents, diabetes, headache, nervous spasms, faintness.

*Incompatibles*: Cardiac sedatives, acids, acid salts, lime water.



*Synergists*: Cardiac and diffusible stimulants, antispasmodics, cap-sicum; locally—cantharides, counter-irritants.

**Ammonii Salicylas.** Ammonium Salicylate,  $\text{NH}_4\text{C}_7\text{H}_5\text{O}_3$ .—(Syn., Fr. Salicylate d'Ammoniaque; Ger. Ammonium salicylicum, Ammoniumsalicylat, Salicylasaures Ammon.)

*Manufacture*: Dissolve salicylic acid (10) in 10 p. c. ammonia water (12), evaporate to dryness. It is in colorless, lustrous, monoclinic prisms or plates, or white, crystalline powder, odorless, saline, bitter, afterward sweetish taste, permanent, soluble in 0.9 part water, 2.3 alcohol, fuses with decomposition, phenol odor, volatile; contains 98 p. c. of pure salt. *Impurities*: Heavy metals, etc. Should be kept cool, dark, in well-stoppered bottles.

**PROPERTIES AND USES.**—Antirheumatic, antipyretic, expectorant, germicide; febrile conditions, bronchitis, rheumatism, gout, etc. Dose, gr. 2–10 (.13–.6 Gm.).

*Allied Salt*:

1. **Ammonii Nitras.** Ammonium Nitrate,  $\text{NH}_4\text{NO}_3$ .—Obtained by (1) neutralizing nitric acid with ammonia water or ammonium carbonate, filtering, evaporating— $\text{NH}_4\text{HCO}_3 + \text{NH}_4\text{NH}_2\text{CO}_2 + 3\text{HNO}_3 = 3\text{NH}_4\text{NO}_3 + \text{H}_2\text{O} + 2\text{CO}_2$ ; (2) neutralizing gas-liquor with  $\text{HNO}_3$  instead of  $\text{HCl}$ ; (3) double decomposition between ammonium sulphate and potassium nitrate. It is in colorless, hexagonal prisms, or long, flexible, thread-like needles, or fused masses, odorless, sharp, bitter taste, soluble in 0.5 part water, 20 alcohol, deliquescent, detonates, hence should be kept in well-stoppered bottles; contains as impurities chloride, sulphate. Properties and uses very similar to those of potassium nitrate, but occasions less cardiac depression; the salt is of considerable importance as being the source of *nitrous oxide gas* (laughing gas, nitrogen monoxide), which is evolved by simply heating it gradually to about  $204^\circ\text{C}$ . ( $400^\circ\text{F}$ .) and passing the gas through two solutions—one being either of potassium hydroxide or lime water, the other of ferrous sulphate, to neutralize acid impurities, and absorb chlorine, ammonia, nitric oxide, etc.; some also pass it through chloroform or its vapor; should always withdraw heat upon the appearance of white fumes in the retort— $\text{NH}_4\text{NO}_3 = \text{N}_2\text{O} + 2\text{H}_2\text{O}$ ; also used in making freezing mixtures. Dose, gr. 1–20 (.06–1.3 Gm.).

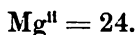
**Ammonii Iodidum.** Ammonium Iodide,  $\text{NH}_4\text{I}$ .—(Syn., Ioduretum Ammonicum; Fr. Iodure d'Ammonium; Ger. Jod Ammonium, Ammonium (jodid) jodatum.)

*Manufacture*: Dissolve in boiling water ammonium sulphate (2), potassium iodide (2.5), stir well, cool, add alcohol (1), evaporate filtrate to dryness, stirring constantly— $(\text{NH}_4)_2\text{SO}_4 + 2\text{KI} = 2\text{NH}_4\text{I} + \text{K}_2\text{SO}_4$ . It is in minute colorless, cubical crystals, or white granular powder, odorless when colorless, but odor of iodine when colored, taste sharp, saline, hygroscopic, soon becomes yellowish-brown, owing to loss of ammonia and liberation of iodine, soluble in 0.6 part water, 9 alcohol,

heated evolves iodine vapor, volatile without fusing; contains 97 p. c. of pure salt. *Impurities*: Heavy metals (iron, etc.), barium, bromides, chlorides, free iodine. Should be kept dark, in well-stoppered bottles, and when deeply colored should not be dispensed unless deprived of free iodine by adding to its concentrated aqueous solution sufficient ammonium sulphide T. S. to render it colorless, filtering, evaporating. Dose, gr. 2–15 (.13–1 Gm.), in water or syrup; ointment (5–10 p. c.), used externally.

**PROPERTIES AND USES.**—Resolvent, resembles potassium iodide very much; secondary syphilis, chronic rheumatism, incipient phthisis, scrofula, enlarged tonsils, lepra, psoriasis, tinea capitis, enlarged glands.

## MAGNESIUM.



The element magnesium (*L. magnesi(a) + um*, district in Thessaly; also name of two cities in Asia Minor) occupies an intermediate place between metals of the alkalis and alkaline earths, with which latter it once was classed, but now has been separated, owing to its closer recognized analogies to zinc, both having volatile chlorides, soluble sulphates, and isomorphous salts.

Magnesium occurs abundantly in nature as chloride and sulphate, in Stassfurt salt-mines, also in numerous spring waters; as carbonate in magnesite; as magnesia calcic carbonate in dolomite (magnesia limestone), which is so profuse in places as sometimes to form the greater bulk of mountain ranges; as silicate in asbestos, meerschaum, serpentine, soapstone, talc, etc.

The metal is obtained by the action of metallic sodium on magnesium chloride— $\text{MgCl}_2 + 2\text{Na} = 2\text{NaCl} + \text{Mg}$ . It is silver-white, losing lustre by oxidation; when heated to redness yields brilliant white light, and  $\text{MgO}$ ; like potassium and sodium, decomposes hot water— $\text{Mg} + 2\text{H}_2\text{O} = \text{Mg}(\text{OH})_2 + 2\text{H}$ . It is not official, but several of its important salts are.

*Tests for Magnesium Salts*: 1. With caustic alkalies get gelatinous, white precipitates, insoluble in excess, but soluble in ammonium chloride. 2. With potassium or sodium carbonate + heat get white precipitate of basic carbonate,  $4\text{MgCO}_3, \text{Mg}(\text{OH})_2$ . 3. With sodium phosphate + ammonium chloride and ammonia get white crystalline precipitate of magnesium-ammonium phosphate,  $\text{MgNH}_4\text{PO}_4$ . 4. Salts are white and soluble, except carbonate, phosphate, arsenate; oxide and hydroxide also are insoluble, the latter being precipitated by  $\text{NaOH}$  or  $\text{KOH}$ .

**Magnesi Sulphas.** Magnesium Sulphate,  $\text{MgSO}_4 + 7\text{H}_2\text{O}$ .—(Syn., Epsom Salt, Sal Amarum—Epsomense—Anglicum or Sedlicense, Sulfas Magnesicus; Fr. Sulfate de Magnésie, Sel d'Epsom, Sel (amer) de Sedlitz; Ger. Magnesium sulfuricum, Magnesiumsulfat, Schwefelsaure Magnesia, Bittersalz.)

**Manufacture:** 1. Chiefly obtained from Stassfurt, as kieserite ( $\text{MgSO}_4 \cdot \text{H}_2\text{O}$ ); heat mineral, dissolve in water, crystallize. 2. By dissolving magnesite (native  $\text{MgCO}_3$ ) in diluted sulphuric acid, filtering, crystallizing— $\text{MgCO}_3 + \text{H}_2\text{SO}_4 = \text{MgSO}_4 + \text{H}_2\text{O} + \text{CO}_2$ . 3. By heating dolomite ( $\text{MgCO}_3 \cdot \text{CaCO}_3$ ) to dissipate  $\text{CO}_2$ , treating residue with  $\text{HCl}$  to take up calcium, and dissolving the remaining magnesium in  $\text{H}_2\text{SO}_4$ . It is in small, colorless, prismatic needles or rhombic prisms, odorless, cooling, saline, bitter taste, slowly efflorescent, soluble in 0.85 part water, insoluble in alcohol, exposed to warm air loses one molecule of water, being converted into a white powder, anhydrous at  $200\text{--}238^\circ \text{C}$ . ( $392\text{--}460^\circ \text{F}$ .); contains 99.7 p. c. of pure salt. **Impurities:** Heavy metals, arsenic. Should be kept in well-closed vessels. Dose,  $\text{ʒss--i}$  (15–30 Gm.), in cold water or effervescing solution.

FIG. 452.



Magnesium sulphate crystal.

**PREPARATIONS.**—1. *Magnesii Sulphas Effervescens*. Effervescent Magnesium Sulphate. (Syn., Effervescent Epsom Salt; Fr. Sulfat de Magnesie Effervescent; Ger. Brausendes Magnesiumsulfat.)

**Manufacture:** Heat slowly magnesium sulphate, crystals, 50 Gm. until it ceases to lose weight, powder, mix with powdered citric acid 13.6 Gm., tartaric acid 21.1, sodium bicarbonate 40.3, heat in oven at  $93\text{--}104^\circ \text{C}$ . ( $199\text{--}219^\circ \text{F}$ .); when mixture moist from careful manipulation with wooden spatula, rub through No. 6 tinned-iron sieve, dry granules at  $54^\circ \text{C}$ . ( $129^\circ \text{F}$ .). Should be kept in well-stoppered bottles. Dose,  $\text{ʒij--8}$  (8–30 Gm.).

2. *Infusum Sennae Compositum*, 12 p. c.

**PROPERTIES AND USES.**—Cathartic, producing safe, painless, watery stools, refrigerant, diuretic; fevers, inflammatory affections, colic, constipation, dysentery, septic fever, intestinal obstruction, pleurisy, painters' (lead, barium) colic.

**Incompatibles:** Alkaline carbonates, lime water, phosphoric acid, phosphates, lead acetate, silver nitrate.

**Magnesii Carbonas.** Magnesium Carbonate, ( $\text{MgCO}_3$ ),  $\text{Mg}(\text{OH})_2 + 5\text{H}_2\text{O}$ .—(Syn., Carbonicas Magnesicus, Magnesia (Alba) Hydricarbonica; Br. Magnesii Carbonas Levis; Fr. Carbonate de Magnésie, Magnésie blanche; Ger. Magnesium carbonicum, Magnesium-carbonat, Kohlensaure Magnesia, Weisse Magnesia.)

**Manufacture:** Mix strong boiling aqueous solutions of magnesium sulphate and sodium carbonate, wash precipitate to remove sodium chloride, dry without heat— $5(\text{MgSO}_4 + 7\text{H}_2\text{O}) + 5(\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}) = [(\text{MgCO}_3)_4 + \text{Mg}(\text{OH})_2 + 5\text{H}_2\text{O}] + 5\text{Na}_2\text{SO}_4 + \text{CO}_2 + 79\text{H}_2\text{O}$ . If a heavier salt is desired (for heavy magnesium oxide), digest the salts in water and evaporate to dryness without filtering, then lixiviate the mass with water to wash out  $\text{Na}_2\text{SO}_4$ , leaving magnesium salt to be dried. It is in light, white friable masses, or bulky, white powder; odorless,

slight earthy taste, permanent, almost insoluble in water, alcohol, soluble in diluted acids with effervescence; upon ignition loses water and carbon dioxide, leaving residue of 40 p. c., of which 96 p. c. should be pure magnesium oxide. *Assay*: 0.400 Gm. recently ignited and cooled, dissolved in 25 Cc. normal sulphuric acid V. S., should require 5.8 Cc. normal potassium hydroxide V. S. for neutralization, using methyl-orange T. S. indicator (each Cc. of normal sulphuric acid V. S. consumed being equivalent to 5 p. c. of pure magnesium oxide). *Impurities*: Heavy metals, iron, calcium, foreign soluble salts. Dose, antacid, gr. 5–20 (.3–1.3 Gm.); laxative, ʒss–1 (2–4 Gm.), in water or milk.

**PREPARATION.**—(Unoff.) *Liquor Magnesii Carbonatis*. Fluid Magnesia (Br.), dose, ʒj–2 (30–60 Cc.).

**PROPERTIES AND USES.**—Antacid, cathartic, antilithic; heartburn, dyspepsia, pregnant vomiting, nauseated stomach with acidity, excessive uric acid secretion, warts, gout; where potassium and sodium salts disagree; externally as a dusting powder in intertrigo, etc., as a cosmetic.

*Allied Salt:*

1. *Magnesii Carbonas Ponderosus*. *Heavy Magnesium Carbonate* (Br.). Dissolve magnesium sulphate 125 Gm. and sodium carbonate 150 Gm., each in water 250 Cc., mix solutions, evaporate to dryness, wash out with water the soluble sodium sulphate, dry. Dose, gr. 5–60 (.3–4 Gm.).

**Magnesii Oxidum**. **Magnesium Oxide**, *Magnesia*,  $MgO$ .—(Syn., *Magnesia*, U. S. P. 1890, *Light Magnesia*, (*Light*) *Calcined Magnesia*, *Light Magnesium*, *Magnesia Calcinata*; Br. *Magnesia Levis*; Fr. *Magnésie*, *Magnésie calcinée*; Ger. *Magnesia usta*, *Gebrannte Magnesia*.)

*Manufacture*: Heat official magnesium carbonate to low redness; water and carbon dioxide escape, leaving magnesium oxide— $4(MgCO_3), Mg(OH)_2, 5H_2O + \text{red heat} = 5MgO + 6H_2O + 4CO_2$ . It is a white, very bulky, fine powder, odorless, earthy taste, not saline, slowly absorbs moisture and carbon dioxide, insoluble in alcohol, almost so in water, soluble in dilute acids; after ignition contains 96 p. c. of pure magnesium oxide; 1 part + 15 water, stirred and let stand half an hour, gelatinizes and will not run from container. *Assay*: Same as for magnesium carbonate. *Impurities*: Heavy metals, iron, calcium carbonate, foreign soluble salts, water of hydration. Should be kept in well-closed vessels. Dose, antacid, gr. 5–20 (.3–1.3 Gm.), after meals; purgative, ʒss–1 (2–4 Gm.), added to water or milk; infants, gr. ʒ (.26 Gm.).

**PREPARATIONS.**—1. *Ferri Hydroxidum cum Magnesii Oxido*, 1 p. c. 2. *Fluidextractum Rhamni Purshianæ Aromaticum*, 12.5 p. c. 3. *Pulvis Rhei Compositus*, 65 p. c.

**PROPERTIES AND USES.**—Like the carbonate; antacid, laxative; dyspepsia, nauseating headache, gout, gravel, heartburn, flatulence, sour eructation, diarrhœa, aphthæ, hemorrhoids, infantile colic, warts, ulcers, abrasions.

**Magnesium Oxidum Ponderosum.** Heavy Magnesium Oxide, Heavy Magnesia,  $\text{MgO}$ .—(Syn., Magnesia Ponderosa, U. S. P. 1890, Heavy Calcined Magnesia; Fr. Magnésie Calcinée pesante; Ger. Schwere gebrannte Magnesia.)

*Manufacture*: Same way as magnesium oxide, only here the heavy carbonate is heated instead of the light carbonate, or can triturate magnesium oxide with alcohol for some time, dry and powder. It is a white, dense, very fine powder; three and a half times heavier than magnesium oxide, and does not, like that, unite readily with water to form gelatinous hydroxide. Dose, gr. 5–40 (.3–2.6 Gm.).

**Liquor Magnesium Citratis.** Solution of Magnesium Citrate.—(Syn., Fr. Limonade au Citrate de Magnésie, Limonade purgative Citro-magnésienne; Ger. Magnesiumcitratlösung, Flüssige Citronensaure Magnesia.)

*Manufacture*: Dissolve citric acid 33 Gm. in water 120 Cc., add magnesium carbonate 15 Gm., when dissolved filter into strong 360-Cc. bottle, add syrup of citric acid 60 Cc., water 150, finally potassium bicarbonate 2.5 Gm., cork securely. Dose, for purge, 1 bottle; as a laxative,  $\frac{1}{2}$  bottle.

**PROPERTIES AND USES.**—Cooling cathartic; operates mildly and is very pleasant.

*Allied Products*:

1. **Talcum.** Talc,  $4\text{MgO} \cdot 5\text{SiO}_2 \cdot \text{H}_2\text{O}$ , *official*.—(Syn., French Chalk, Steatite, Soapstone, Talcum Venetum; Fr. Talc de Vénise, Craie de Briançon; Ger. Talk, Talkstein, Speckstein.)

*Manufacture*: This native hydrous magnesium silicate is found to a large extent in Austria, Sweden, Bohemia, New Jersey, etc., having frequently associated with it ferrous oxide, alumina, and lime. It is a white or grayish-white powder, or grayish-green irregular masses, waxy lustre, rubbed upon skin imparts feeling like greasiness, permanent, odorless, tasteless, insoluble in water, dilute solutions of acids and alkali hydroxides, sp. gr. 2.2–2.8. *Test*: 1. Boil 1 Gm. with diluted hydrochloric acid 25 Cc. for 1 hour, maintaining the volume with additional water, filtrate upon evaporation and ignition should weigh 0.05 Gm.

**PREPARATION.**—1. *Talcum Purificatum.* Purified Talc.—(Syn., Fr. Talc purifié; Ger. Gereinigter Talk.)

*Manufacture*: Boil 15 minutes 500 Gm. with water 2,500 Cc. + hydrochloric acid 50 Cc., gradually added, let stand 15 minutes, reject supernatant liquid, again boil with water 2,500 Cc. + hydrochloric acid 25 Cc., let stand 15 minutes, reject liquid, wash thoroughly, drain, dry at  $110^\circ \text{C}$ . ( $230^\circ \text{F}$ ). When heated to redness should lose only 5 p. c. *Impurities*: Iron, soluble substances.

**PROPERTIES AND USES.**—Chiefly as an aid in filtering, etc.

2. **Magnesium Citras Effervescens.** Effervescent Magnesium Citrate.—Obtained by mixing magnesium carbonate 10 Gm. + citric acid 30, with distilled water 4 Cc., drying, powdering, mixing with sugar

8 Gm., sodium bicarbonate 34, citric acid 16, moistening with alcohol, rubbing through No. 6 tinned-iron sieve. It is a white, coarsely granular salt, odorless, mild acid, refreshing taste, deliquescent, soluble with effervescence in 2 parts water, insoluble in alcohol. *Impurities*: Tartrate, etc.; should be kept in well-closed vessels.

**PROPERTIES AND USES.**—Similar to liquor magnesi citratis, being more portable but not so pleasant. Dose, ʒj–3 (4–12 Gm.).

## CALCIUM.

$\text{Ca}^{\text{II}} = 40.$

The element calcium (*L. calx, calcis*, limestone, Gr.  $\chi\acute{\alpha}\lambda\iota\varsigma$ ) is one of a group of three—calcium, barium, strontium—which form the alkaline earths. These metals, like the alkalis and magnesium, decompose water, liberating hydrogen; metallic calcium is light, yellow, ductile like gold, malleable; seldom met with except as the native salts, which are very abundant. The carbonate occurs in calc-spar, chalk, limestone, marble, shells of eggs, mollusca, etc.; acid carbonate in water; sulphate in alabaster, gypsum, bones; phosphate in apatite, animal bone, etc.; fluoride in fluor spar; chloride in water; silicate in rocks of various kinds.

*Tests for Calcium Salts*: 1. With soluble salts the alkaline carbonates give white precipitates, insoluble in excess. 2. With ammonium or potassium oxalate we get a white precipitate, insoluble in acetic but soluble in hydrochloric acid. 3. With sulphuric acid or KOH or NaOH get white precipitates in strong calcium solutions, but not in diluted solutions. 4. Give reddish-yellow color to flame.

**Calx. Lime, CaO.**—(Syn., Burned Lime, Calcaria, Calx Viva, Calx Usta, Quicklime, Oxydum Calcicum, Calcium Oxide; Fr. Chaux (vive); Ger. Calcaria usta, Gebrannter Kalk, Kalk, Aëtzkalk.)

*Manufacture*: By calcining white marble or the purest varieties of native calcium carbonate— $\text{CaCO}_3 + \text{heat} = \text{CaO} + \text{CO}_2$ . It is in hard, white, or grayish-white masses, which exposed gradually attracts moisture and carbon dioxide (air-slaked), falling to a white powder, odorless, caustic taste, soluble in 760 parts water, insoluble in alcohol, forms soluble salts with diluted acetic, hydrochloric, and nitric acids; sprinkled with half its weight of water heat is produced thereby converting it gradually into a white powder (calcium hydroxide, slaked lime), this when mixed with 3–4 parts water forms smooth magma (milk of lime); contains 90 p. c. of pure salt. *Impurities*: Carbonate, etc. Should be kept dry, in well-closed containers.

**PREPARATIONS.**—1. *Liquor Calcis*. Lime Water, Solution of Calcium Hydroxide. (Syn., Solution of Lime, Aqua Calcis, Calcaria Soluta, Oxydum Calcicum Aqua Solutum; Fr. Eau (Liqueur) de Chaux; Ger. Aqua Calcariae (Ustæ), Kalkwasser.)

*Manufacture*: This saturated aqueous solution is prepared by slaking lime 12 Gm. with distilled water 400 Cc., gradually added, agitating

occasionally half an hour, decanting and rejecting supernatant liquid, adding to residue distilled water 3,600 Cc., agitating, letting stand 24 hours, agitating, letting coarser particles subside, pouring off and reserving liquid holding undissolved calcium hydroxide in suspension; shake occasionally to keep saturated, pour off clear liquid when required for use. It is a clear, colorless, odorless liquid, alkaline taste, absorbs carbon dioxide from air, hence a pellicle of  $\text{CaCO}_3$  forms on the surface of the liquid, when heated becomes turbid from deposit of  $\text{Ca(OH)}_2$ , which redissolves upon cooling. It is usually made from ordinary limestone, which is not pure calcium carbonate, but contains some alkalies—it is to dissolve these latter that the first 400 parts of water are added and then rejected; contains at  $15^\circ \text{C}$ . ( $59^\circ \text{F}$ .) 0.14–0.17 p. c. of pure salt,  $\text{Ca(OH)}_2$ , the percentage varying slightly, being less as temperature rises. *Assay*: 50 Cc. should require 19 Cc.  $\frac{N}{10}$  sulphuric acid V. S. for neutralization (corresponding to 0.14 (0.148) p. c. of  $\text{Ca(OH)}_2$ ), using phenolphthalein T. S. indicator. *Impurities*: Alkalies and their carbonates. *Dose*,  $\text{℥ss}$ –4 (15–120 Cc.).

*Prep.*: 1. *Linimentum Calcis*. Lime Liniment. (Syn., Carron Oil; Fr. Liniment calcaire, Savon calcaire; Ger. Kalkliniment.)

*Manufacture*: Mix by agitation lime water 50 Cc. with linseed oil 50 Cc.; used externally.

2. *Syrupus Calcis*. Syrup of Lime, Syrup of Calcium Hydroxide. (Syn., Br. Liquor Calcis Saccharatus, Syrupus Calcariae; Fr. Sirop de Chaux; Ger. Kalksirup.)

*Manufacture*: Slake lime 6.5 Gm. with water 3.5 Cc., by aid of heat, mix with sugar 35 Gm., add mixture to 50 Cc. boiling water, boil 5 minutes, constantly stirring, add water q. s. 95 Cc., filter, adding water q. s. 100 Cc. It is a transparent, pale yellow liquid, alkaline taste and reaction, sp. gr. 1.145. *Tests*: 1. Alkali carbonate solution gives white precipitate, soluble in acids with effervescence. 2. Ammonium oxalate T. S. gives white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid. Should be kept in well-stoppered bottles.

*Unoff. Prep.*: *Liquor Calcis Saccharatus* (Br.), slaked lime 5 p. c. (=  $\text{CaO}$  2 p. c.), sugar 10, water q. s. 100 Cc., dose  $\text{℥ss}$ –1 (2–4 Cc.).

**PROPERTIES AND USES.**—Lime—escharotic, depilatory, antacid, arrests putrefaction, hence added to stools of dysentery, cholera, typhoid fever, cesspools, sewers, ulcers, favus, psoriasis; Liquor—astrigent, antacid; diarrhoea, diabetes, gravel, dyspepsia, scabies, tinea capitis, ulceration of bladder, urethra, mucous and purulent discharges, ascari-ides of the rectum, chronic bronchitis, vomiting, nausea, prevents milk curdling in stomach, aphthæ, thrush, typhoid fever, phthisis, rachitis, cutaneous eruptions, antidote to arsenic trioxide; Liniment—burns, scalded throat, etc.; Syrup—acute rheumatism, infantile diarrhoea, vomiting, urinary affections.

**Calx Chlorinata.** Chlorinated Lime, Chlorinated Calcium Oxide.—(Syn., Calx Chlorata, U. S. P. 1890, Chloride of Lime (misnomer),

Calcium Hypochlorite, Bleaching Powder, Oxymuriate of Lime, Chloris Calcicus, Chloruretum Calcis, Calcis Chloridum, Calcii Hypochloris; Fr. Chlorure de Chaux, Poudre de Tennant ou de Knox; Ger. Calcaria chlorata, Chlorkalk, Bleichkalk.)

*Manufacture:* Powdered slaked lime is spread upon shelves arranged in boxes or chambers into which from the top chlorine gas is passed as long as it is absorbed, at a temperature not above  $25^{\circ}\text{C}$ . ( $77^{\circ}\text{F}$ .), to avoid formation of calcium chlorate— $2\text{Ca}(\text{OH})_2 + 4\text{Cl} = \text{Ca}(\text{ClO})_2 + \text{CaCl}_2 + 2\text{H}_2\text{O}$ . It is a white, or grayish-white, granular powder, odor of hypochlorous acid (chlorine), repulsive, saline taste, becoming moist and decomposing by exposure, partly soluble in water or alcohol; contains 30 p. c. of available chlorine. *Assay:* Weigh accurately 3–4 Gm., triturate with 50 Cc. water, transfer to graduated vessel, add water q. s. 1,000 Cc., shake; to 100 Cc. of this add 1 Gm. potassium iodide, 5 Cc. diluted hydrochloric acid, + sufficient  $\frac{\text{N}}{10}$  sodium thiosulphate T. S. for complete decolorization; multiply number Cc. of V. S. consumed by 0.03518, divide product by one-tenth of weight taken, the quotient = p. c. of available chlorine. Should be kept cool, dry, in well closed containers. Dose, gr. 1–5 (.06–.3 Gm.), in solution; mouth wash (1 p. c.); lotion (3–5 p. c.); ointment (10 p. c.).

*PREPARATION.* — 1. *Liquor Sodæ Chlorinata*. Solution of Chlorinated Soda. (Syn., *Liquor Sodæ Chlorata*, U. S. P. 1890, Labarraque's Solution, *Liquor Natri (Chlorati) Hypochlorosi*; Fr. Chlorure de Soude liquide, *Liqueur de Labarraque*; Ger. Bleichflüssigkeit, Chlornatronlösung.)

*Manufacture:* Triturate chlorinated lime 9 Gm. with 50 Cc. water, in three portions (20, 20, 10), filter, dissolve monohydrated sodium carbonate 6.5 Gm. in 30 Cc. hot water, and add it to previous filtrate, shake, if gelatinous, heat until precipitate subsides, filter, washing filter with water q. s. 100 Gm. By double decomposition calcium carbonate is precipitated, while chlorinated soda and sodium chloride remain in solution— $2\text{Na}_2\text{CO}_3 + \text{Ca}(\text{ClO})_2 + \text{CaCl}_2 = 2(\text{NaClO}, \text{NaCl}) + 2\text{CaCO}_3$ ; hot water is used to make precipitate of  $\text{CaCO}_3$  compact, as careless direct heat might decompose solution into chloride, and chlorate with evolution of oxygen. It is a clear, pale greenish, aqueous liquid, chlorine odor, disagreeable alkaline taste, consisting of several chlorine compounds of sodium, sp. gr. 1.050, with HCl get effervescence of Cl and  $\text{CO}_2$ ; contains 2.4 p. c. by weight of available chlorine. *Assay:* 7 Gm. + 50 Cc. water, + 2 Gm. potassium iodide, + 10 Cc. hydrochloric acid should require 48 Cc.  $\frac{\text{N}}{10}$  sodium thiosulphate V. S. to discharge final yellow color of liquid (each Cc. of V. S. corresponding to 0.05 p. c. of available chlorine). Should be kept cool, dark, in well-stoppered bottles. Dose,  $\text{Mxxx}$ –40 (2–2.6 Cc.), in water or some mild liquid; as a gargle or injection should be diluted 8–10 times with water.

*Unoff. Prep.:* *Liquor Calcis Chlorinata* (Br.), 10 p. c. + water.

*PROPERTIES AND USES.*—Desiccant, disinfectant (one of the very best), deodorizer; ulcers, chilblains, burns, skin affections, itch, putrid sore throat, ulcerated gums, dysentery, typhus fever, scrofulous en-



largements, ophthalmia, aphthæ, cancers, foul breath, mercurial salivation, antidote to hydrocyanic acid and hydrosulphuric acid. Liquor—stimulant, antiseptic, resolvent, typhus fever, scarlatina, dysentery, glandular enlargements, dyspepsia, syphilis, scrofula, carbuncles, ozaena, psoriasis, tinea capitis, scabies, herpetic affections, smallpox, sore nipples, disinfect sick-chambers, etc.

**Calx Sulphurata. Sulphurated Lime.**—(Syn., Crude Calcium Sulphide, Hepar Calcis, Hepar Sulphuris Calcareum; Fr. Sulfure de Chaux; Ger. Kalkschwefelleber, Calcaria sulfurata.)

*Manufacture:* Dried calcium sulphate 70 Gm., charcoal 10, starch 2; mix and heat to redness until black color lost— $\text{CaSO}_4 + \text{C} = \text{CaS} + 2\text{CO} + \text{CO}_2$ . It is a pale-gray powder, faint odor of hydrogen sulphide, nauseous, alkaline taste, decomposed by exposure, slightly soluble in water, insoluble in alcohol, decomposed by diluted acetic acid into calcium acetate, hydrogen sulphide, calcium sulphate and carbon; it is a mixture containing at least 60 p. c. of calcium sulphide, CaS, with unchanged calcium sulphate,  $\text{CaSO}_4$ , and carbon in varying proportions. *Assay:* 1 Gm. + 2.08 Gm. cupric sulphate in 50 Cc. water + 10 Cc. diluted hydrochloric acid, added in small portions with constant stirring, this mixture digested 15 minutes on water-bath, filtered, + excess ammonia water, should impart no color to filtrate (pres. of at least 60 p. c. of pure calcium sulphide). Should be kept in small, well-stoppered bottles. Dose, gr.  $\frac{1}{10}$ – $\frac{1}{2}$  (.006–.03 Gm.).

**PROPERTIES AND USES.**—Depilatory, itch, ringworm, acne, furuncular eruptions, buboes, leucorrhœa, rhinitis, diphtheria, rheumatism.

**Calcii Chloridum. Calcium Chloride,  $\text{CaCl}_2$ .**—(Syn., Chloridum Calcium, Calcium Chloratum, Calcaria (Muriatica) Hydrochlorata; Fr. Chlorure de Calcium, Hydrochlorate de Chaux; Ger. Calciumchlorid, Chlorcalcium, Salzaures Kalk.)

*Manufacture:* In the crude state this is a by-product in several chemical processes, especially that for ammonia water; it may be obtained pure by neutralizing hydrochloric acid with marble or other calcium carbonate, digesting the solution with chlorinated lime and slaked lime (to precipitate iron), neutralizing filtrate with hydrochloric acid, evaporating and fusing residue at  $200^\circ \text{C}$ . ( $392^\circ \text{F}$ .)— $\text{CaCO}_3 + 2\text{HCl} = \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ ; contains at least 99 p. c. of pure salt. It is in white, slightly translucent, hard fragments, odorless, sharp, saline taste, very deliquescent, soluble in 1.5 parts water, 8 alcohol; contains 99 p. c. of pure salt. *Impurities:* Arsenic, lead, magnesium, alkalis, iron, aluminum, phosphates. Should be kept in well-stoppered bottles. Dose, gr. 10–20 (.6–1.3 Gm.), in water or milk.

**PROPERTIES AND USES.**—Irritant—excessive doses occasion gastrointestinal inflammation; Resolvent—glandular enlargements, scrofulous swellings, skin diseases, lupus, uterine and ovarian tumors, fibroids.

**Calcii Carbonas Præcipitatus. Precipitated Calcium Carbonate,  $\text{CaCO}_3$ .**—(Syn., Precipitated Chalk, Creta Præcipitata, Carbonas

Calculus Præcipitatus; Fr. Carbonate de Chaux précipité, Craie précipitée; Ger. Calcium carbonicum præcipitatum, Calciumcarbonat, Präcipitirter kohlensaurer Kalk.)

*Manufacture*: By double decomposition—adding to a hot solution of calcium chloride, while stirring, a solution of ammonium carbonate in excess, washing, drying precipitate, or may use sodium carbonate in place of ammonium carbonate— $\text{CaCl}_2 + \text{Na}_2\text{CO}_3 = \text{CaCO}_3 + 2\text{NaCl}$ . It is a fine, white powder, odorless, tasteless, permanent, nearly insoluble in alcohol, water, solubility increased by presence of ammonium salts and carbon dioxide, soluble in diluted acetic, hydrochloric or nitric acid with effervescence, heated to redness loses  $\text{CO}_2$ , leaving residue of calcium oxide; contains 99 p. c. of pure salt. *Impurities*: Heavy metals (iron, etc.), aluminum, phosphates, soluble substances, etc.

PREPARATIONS.—1. *Pulvis Morphinae Compositus*, 33.5 p. c., etc.

PROPERTIES AND USES.—See *Creta præparata*.

*Allied Salt*:

1. *Calcii Glycerophosphas*. *Calcium Glycerophosphate*,  $\text{C}_3\text{H}_5(\text{OH})_2\text{CaPO}_4 + \text{H}_2\text{O}$ .—Obtained by neutralizing a solution of glycerophosphoric acid with milk of lime or calcium carbonate, concentrating filtrate in vacuo. It is a white, neutral, crystalline powder, soluble in 20 parts water, insoluble in alcohol, and almost so in boiling water. Nerve tonic, restorative, wherever calcium and phosphorus are demanded; the phosphorus of lecithin of food is converted to glycerophosphoric acid before assimilation, hence this becomes the most natural form for administering phosphorus. Wasting diseases, convalescence, rachitis, sciatica. Dose, gr. 2–5 (.13–.3 Gm.), in solution, syrup, wine.

*Creta Præparata*. Prepared Chalk,  $\text{CaCO}_3$ .—(Syn., *Creta Lævigata*; Fr. Craie préparée, Craie Lavée; Ger. Präparirte Kreide, Schlammkreide.)

*Manufacture*: Chalk is a very abundant mineral, occurring largely on the English Channel coast. It consists of infinitesimal shells of foraminifera, composed mostly of  $\text{CaCO}_3$ , but having more or less silica, aluminum, iron, magnesium, and organic matter. Our official prepared chalk is, then, this native friable  $\text{CaCO}_3$ , freed from nearly all of these impurities by elutriation, which consists in washing finely powdered chalk or whiting (the latter being the deposit from the first washings of water) with cold water, allowing the coarser particles to subside, decanting milky liquid on straining cloths, collecting moist residue and forming same into small nodules by dropping soft mass from a funnel-shaped vessel on to a drying-tray, or may be moulded into crayon-sticks, and in either shape left white or tinted with various coloring substances. It is a fine, grayish white, amorphous powder, odorless, tasteless, permanent, nearly insoluble in water, alcohol, soluble in diluted acetic, hydrochloric, or nitric acid with effervescence, if heated loses  $\text{CO}_2$ , yielding  $\text{CaO}$ . *Impurities*: Iron, magnesium, barium, sulphate; gypsum often sold for it.

PREPARATIONS.—1. *Pulvis Cretæ Compositus*. Compound Chalk Powder. (Syn., Fr. Poudre de Craie composée; Ger. Kreidepulver mit Gummi.)

*Manufacture*: 30 p. c. Mix thoroughly prepared chalk 30 Gm., acacia 20, sugar 50. Dose, gr. 5–60 (.3–4 Gm.).

Prep.: 1. *Mistura Cretæ*. Chalk Mixture. (Syn., Fr. Mixture avec la Craie; Ger. Kreidemixtur.)

*Manufacture*: Rub thoroughly in a mortar compound chalk powder 20 Gm. with cinnamon water 40 Cc., water q. s. 100 Cc. Dose,  $\mathfrak{zj}$ –4 (4–15 Cc.).

2. *Hydrargyrum cum Creta*, 57 p. c., + mercury 38 p. c.

*Unoff. Preps.*: *Troches*,  $3\frac{1}{4}$  gr. (.24 Gm.). *Pulvis Cretæ Aromaticus* (Br.), dose, gr. 15–60 (1–4 Gm.). *Pulvis Cretæ Aromaticus cum Opii* (Br.)—opium 2.5 p. c., dose, gr. 10–40 (.6–2.6 Gm.).

PROPERTIES AND USES.—Mainly in tooth powders, etc.; the precipitated is considered best for such preparations, as it is finer and contains no grit; the prepared is preferable for chalk mixtures, face and toilet powders, from its more adhesive properties, dusting powder to ulcers, burns, abrasions; antidote to oxalic acid poisoning; the troches used as a mild astringent, antacid in diarrhoea, gastric acidity (preceded by a purge), being well adapted for children; the mistura for diarrhoea, loose bowels of infants, etc.

*Incompatibles*: Acids and sulphates.

*Allied Salt*:

1. *Calcis Carbonas*. *Carbonate of Lime*.—Formerly official under two forms, viz.:

1. *Calcis Carbonas Durus* (hard), Marmor, Marble.—Official 1830–1880. Also called “native white granular carbonate of lime.”

2. *Calcis Carbonas Mollis* (soft), Creta, Chalk.—Official 1830–1880. Also called “native friable carbonate of lime.”

*Calcii Bromidum*. *Calcium Bromide*,  $\text{CaBr}_2$ .—(Syn., Fr. Bromure de (Chaux) Calcium; Ger. Bromcalcium, Calcium (bromid) bromatum.)

*Manufacture*: Dissolve pure calcium carbonate in hydrobromic acid, filter, evaporate to dryness— $\text{CaCO}_3 + 2\text{HBr} = \text{CaBr}_2 + \text{H}_2\text{O} + \text{CO}_2$ , or by boiling milk of lime with ammonium bromide. It is a white granular salt, odorless, sharp, saline taste, very deliquescent, soluble in 0.5 part water, 1 alcohol, partially decomposed by heat, with loss of bromine; contains 97 p. c. of pure salt. *Impurities*: Heavy metals, barium, iodine, bromate, nitrates, ammonia, insoluble substances. Should be kept in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.), in water.

PROPERTIES AND USES.—As a substitute for potassium bromide; hypnotic, sedative, in insomnia, hysteria, epilepsy; depresses heart less than potassium bromide.

*Calcii Hypophosphis*. *Calcium Hypophosphite*,  $\text{Ca}(\text{PH}_2\text{O}_2)_2$ .—(Syn., Hypophosphis Calcicus, Hypophosphite of Lime; Fr. Hypophos-

phite de Chaux ; Ger. Calcium Hypophosphorosum, Calcaria Hypophosphorosa, Unterphosphorigsaurer Kalk.)

*Manufacture* : Boil phosphorus in milk of lime, when dissolved pass  $\text{CO}_2$  into the solution to precipitate excess of lime, filter, crystallize— $8\text{P} + 3\text{Ca}(\text{OH})_2 + 6\text{H}_2\text{O} = 3\text{Ca}(\text{PH}_2\text{O}_2)_2 + 2\text{PH}_3$  (inflammable phosphine). It is in colorless, transparent, monoclinic prisms, or small lustrous scales, or white crystalline powder, odorless, nauseous, bitter taste, permanent, soluble in 6.5 parts water, insoluble in alcohol, when heated decrepitates, decomposing into inflammable gases (hydrogen and hydrogen phosphide), water, leaving as residue calcium pyrophosphate and metaphosphate, with some red phosphorus ; contains 98 p. c. of pure salt. *Impurities* : Heavy metals, arsenic, phosphate, sulphate. Should be kept in well-stoppered bottles, and dispensed with caution, as explosion is liable to occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.).

*PREPARATIONS*.—1. *Emulum Olei Morrhue cum Hypophosphitibus*, 1 p. c. 2. *Syrupus Hypophosphitum*, 4.5 p. c. 3. *Syrupus Hypophosphitum Compositus*, 3.5 p. c.

*PROPERTIES AND USES*.—Stimulant to nervous system, chronic phthisis, scrofulous diseases, caries, chlorosis, menorrhagia, fractures, rickets, Pott's disease ; possibly in the stomach converted into phosphate and absorbed as lactophosphate. In pharmacy this salt is the base of all the other hypophosphites, along with which others this often is prescribed.

**Calcii Phosphas Præcipitatus. Precipitated Calcium Phosphate,  $\text{Ca}_3(\text{PO}_4)_2$** .—(Syn., Phosphas Calcicus Præcipitatus, Calcaria Phosphorica ; Fr. Phosphate de Chaux hydraté ; Ger. Calcium phosphoricum, Calciumphosphat, Phosphorsaure Kalkerde.)

*Manufacture* : Dissolve bone-ash (bone calcined to whiteness and in fine powder) in moderately dilute hydrochloric acid, forming acid calcium phosphate and calcium chloride in solution, which is then poured into dilute ammonia water in excess— $\text{Ca}_3(\text{PO}_4)_2 + 4\text{HCl} = \text{Ca}(\text{H}_2\text{PO}_4)_2 + 2\text{CaCl}_2$ ;  $\text{Ca}(\text{H}_2\text{PO}_4)_2 + 2\text{CaCl}_2 + 4\text{NH}_4\text{OH} = \text{Ca}_3(\text{PO}_4)_2 + 4\text{NH}_4\text{Cl} + 4\text{H}_2\text{O}$  ; a purer salt is made thus— $2\text{Na}_2\text{HPO}_4 + 3\text{CaCl}_2 + 2\text{NH}_4\text{OH} = \text{Ca}_3(\text{PO}_4)_2 + 4\text{NaCl} + 2\text{NH}_4\text{Cl} + 2\text{H}_2\text{O}$ . It is a bulky, white, amorphous powder, colorless, tasteless, permanent, almost insoluble in water, partly decomposed by boiling water as it dissolves out the acid salt, soluble in hydrochloric or nitric acid, insoluble in alcohol, nearly so in acetic acid ; contains 99 p. c. of pure salt. *Impurities* : Heavy metals, arsenic, barium, acid calcium phosphate, carbonate, chloride. Dose, gr. 5–30 (.3–2 Gm.).

*PREPARATION*.—1. *Syrupus Calcii Lactophosphatis*. Syrup of Calcium Lactophosphate. (Syn., Fr. Sirop de Lactophosphate (Phospholactate) de Chaux ; Ger. Calciumphospholactatsirup.)

*Manufacture* : Dissolve precipitated calcium carbonate 2.5 Gm. in lactic acid 6 Cc. + water 10, add phosphoric acid 3.6 diluted with 5 Cc. water, when precipitate dissolves add water 15, filter, add orange-

flower water 5, sugar 72.5 Gm., when dissolved by agitation add water q. s. 100 Cc. Dose, ʒij-4 (8-15 Cc.).

**PROPERTIES AND USES.**—In defective nutrition, rickets (mollities ossium), scrofulous affections, chronic phthisis, fractures, night-sweats.

In pharmacy, owing to its insolubility in water, is used instead of magnesium carbonate, for making medicated waters and clarifying various mixtures.

**Calci Sulphas Exsiccatus. Dried Calcium Sulphate.**—(Syn., Dried Gypsum, Plaster of Paris; Fr. Plâtre cuit; Ger. Calcium sulfuricum ustum, Gebrannter Gips.)

**Manufacture:** From the purer varieties of native gypsum,  $\text{CaSO}_4 + 2\text{H}_2\text{O}$ , by carefully heating to  $105^\circ \text{C}$ . ( $221^\circ \text{F}$ .) until three-fourths of the water has been expelled— $\text{CaSO}_4 + 2\text{H}_2\text{O} + \text{heat} = \text{CaSO}_4$ . It is a fine, white powder, odorless, tasteless, exposed to moist air absorbs water, becoming granular, losing the property of hardening with water, mixed with half its weight of water forms a smooth paste which rapidly hardens, soluble in 378 parts water, readily in diluted nitric or hydrochloric acid, saturated solution potassium nitrate, sodium thiosulphate, ammonium salts, insoluble in alcohol; contains 95 p. c., by weight, of pure salt, and 5 p. c. of water. **Impurities:** Carbonate, water. Should be kept in well-closed containers, carefully protected from moisture.

**PROPERTIES AND USES.**—Not employed internally, but mainly by surgeons for mechanical purposes, in making casts, supports, etc., to immobilize injured or diseased portions of the body—fractures, Pott's disease (spinal), lateral curvature, deformities of ankle- and knee-joints, to fix bandages in amputation; in dental surgery for taking oral impressions, moulds for interdental splints, etc.

## BARIUM.

$\text{Ba}^{\text{II}} = 136.9$ .

The element barium (*L. bar(ytes) + ium*, fr. Gr. βαρύς, heavy, owing to high sp. gr. of heavy spar) and its compounds are not much used in medicine; it is found rarely in nature, and occurs then chiefly as sulphate (barite or heavy spar,  $\text{BaSO}_4$ ), also as carbonate (witherite,  $\text{BaCO}_3$ ). The metal fuses with difficulty, is of a silvery-gray color, decomposes water, oxidizes rapidly, sp. gr. 3.6. Salts are poisonous, and their antidotes are sodium and magnesium sulphates. The sulphate is used to adulterate white lead; the nitrate in preparing green fire.

**Tests for Barium Salts:** 1. With  $\text{H}_2\text{SO}_4$  or a soluble sulphate get white precipitate of barium sulphate, insoluble in all acids. 2. With alkaline carbonate get white precipitate, insoluble in excess. 3. With  $\text{K}_2\text{Cr}_2\text{O}_7$  get pale yellow precipitate of  $\text{BaCrO}_4$ . 4. Gives yellowish-green color to flame.

Barium compounds, although poisonous, are used sometimes in medicine as alterative, diuretic, cardiac tonic, cutaneous affections, scrofula.

*Poisoning:* Have salivation, thirst, vomiting, purging, abdominal pains, cramps, feeble pulse, dilated pupils, excessive urination, difficult breathing, spine paralysis, convulsions, collapse, death. Give emetics, magnesium or sodium sulphate, albuminous drinks, diffusible stimulants, digitalis, opium, heat.

*Important Salts:*

1. *Barii Sulphas.* *Barium Sulphate*,  $\text{BaSO}_4$ .—Official 1830–1840. This is a native mineral (heavy spar) from which the other barium compounds are prepared. It is heavy, lamellar, brittle, sp. gr. 4.6, white or flesh-red. When heated decrepitates, melting into a white enamel (sulphide), which becomes a powder after some hours, insoluble in most solvents, therefore non-poisonous; soluble in excess of diluted hydrochloric acid. The artificial sulphate, made by precipitation from sulphide solution with diluted  $\text{H}_2\text{SO}_4$ , is known as *permanent white* or *blanc fix*, used for glazing cards, in water colors, and by painters instead of white lead.

2. *Barii Carbonas.* *Barium Carbonate*,  $\text{BaCO}_3$ .—Official 1870–1880. This is native *witherite*, found in lead mines in England, Scotland, Sweden. May be obtained artificially by precipitating a soluble barium salt with an alkali carbonate, or may fuse barium sulphate 10 parts, carbon 2, potassium hydroxide 5; wash the mass with water, thus leaving behind the carbonate— $\text{BaSO}_4 + \text{C}_2 + 2\text{KOH} = \text{BaCO}_3 + \text{K}_2\text{S} + \text{CO}_2 + \text{H}_2\text{O}$ . It is in grayish fibrous masses or rhombic crystals, sp. gr. 4.5. If made artificially, it is a soft, white, amorphous or crystalline, tasteless powder. *Impurities:* Sulphate, lead, metals, alkalies, calcium.

Other barium salts may readily be made by acting upon this salt with the respective acids; thus, nitrate— $\text{BaCO}_3 + 2\text{HNO}_3 = \text{Ba}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$ , hydroxide— $\text{BaCO}_3 + 2\text{KOH} = \text{Ba}(\text{OH})_2 + \text{K}_2\text{CO}_3$ , also bromide, iodide, etc.

3. *Barii Chloridum.* *Barium Chloride*,  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ .—Official 1870–1880. Obtained by dissolving barium carbonate in diluted  $\text{HCl}$ , evaporating, crystallizing— $\text{BaCO}_3 + 2\text{HCl} = \text{BaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ ; or (1)  $\text{BaSO}_4 + \text{C}_2 + \text{white heat} = \text{BaS} + 2\text{CO}_2$ , (2)  $\text{BaS} + 2\text{HCl} = \text{BaCl}_2 + \text{H}_2\text{S}$ . While the first method, in which the native carbonate is used, is the better, that salt is so scarce that the second formula is followed generally. It is in colorless, translucent, rhomboidal tables or lamellæ, permanent, soluble in diluted alcohol or water. *Impurities:* Carbonate, sulphate, lead, metals, alkalies, calcium, strontium chloride. Used only in making *Liquor Barii Chloridi* (10 Gm. + water q. s. 100 Cc.).

4. *Barii Dioxidum.* *Barium Dioxide*,  $\text{BaO}_2$ .—Official 1890–1900. Obtained by passing oxygen or air over barium oxide or hydroxide heated to redness. It is a heavy grayish or yellowish-white amorphous coarse power, odorless, tasteless, nearly insoluble in water, forms salts with acids, slowly decomposes, absorbing  $\text{H}_2\text{O}$  and  $\text{CO}_2$ . Used only in making *Aqua Hydrogenii Dioxidii*.

The test-solutions of the carbonate, chloride, hydroxide, and nitrate are all used officially in assaying official salts, acids, etc.

## STRONTIUM.

$$\text{Sr}^{\text{II}} = 87.4.$$

The element strontium (L. fr. *strontian*, in Argyleshire, Scotland, where first found as *strontianite*,  $\text{SrCO}_3$ ) in the form of its compounds was not until recently used to any extent in medicine. It occurs natively as sulphate (*celestite*,  $\text{SrSO}_4$ ) and carbonate. The metal itself is yellow, malleable, harder than lead, sp. gr. 2.5, oxidizes quickly when exposed, hence has to be kept under naphtha, like the alkali metals. The salts can be produced in a manner similar to those of barium, thus: Heat strontium sulphate with carbon, which gives strontium sulphide; this sulphide dissolved in  $\text{HCl}$  yields the chloride, which by double decomposition with  $\text{Na}_2\text{CO}_3$  gives pure strontium carbonate, from which all official salts are made.

*Tests for Strontium Salts:* 1. With alkaline carbonates, oxalates, or phosphates get white precipitate. 2. With calcium sulphate get white precipitate of  $\text{SrSO}_4$ . 3. With  $\text{H}_2\text{SO}_4$  or a soluble sulphate get white precipitate. 4. Add potassium chromate and get yellow precipitate,  $\text{SrCrO}_4$ , soluble in acids; here  $\text{K}_2\text{Cr}_2\text{O}_7$  gives no precipitate. 5. Gives a beautiful red color to flame.

**Strontii Bromidum.** Strontium Bromide,  $\text{SrBr}_2 + 6\text{H}_2\text{O}$ .—(Syn., Fr. Bromure de Strontium; Ger. Strontiumbromid.)

*Manufacture:* Dissolve strontium carbonate in hydrobromic acid until neutralized, evaporate, crystallize— $\text{SrCO}_3 + 2\text{HBr} = \text{SrBr}_2 + \text{H}_2\text{O} + \text{CO}_2$ . It is in colorless, transparent, hexagonal crystals, odorless, bitter, saline taste, very deliquescent, soluble in 1 part water, also in alcohol, from which it is precipitated by ether; contains 97 p. c. of pure salt. *Assay:* 0.5 Gm. + distilled water 50 Cc. + few drops potassium chromate T. S., should require 27.4–29.4 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to produce permanent red color (corresponding to 97 p. c. of pure salt). *Impurities:* Heavy metals, barium, iodide. Should be kept in glass-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).

**PROPERTIES AND USES.**—Similar to potassium bromide—epilepsy, gastric disorders, albuminuria.

**Strontii Iodidum.** Strontium Iodide,  $\text{SrI}_2 + 6\text{H}_2\text{O}$ .—(Syn., Fr. Iodure de Strontium; Ger. Strontiumjodid.)

*Manufacture:* Dissolve strontium carbonate in hydriodic acid until neutralized, evaporate, crystallize— $\text{SrCO}_3 + 2\text{HI} = \text{SrI}_2 + \text{H}_2\text{O} + \text{CO}_2$ . It is in colorless, transparent, hexagonal plates, odorless, bitter, saline taste, deliquescent, turning yellow by exposure, soluble in alcohol, 0.5 part water; when heated loses water (24.05 p. c.), if to red heat loses iodine, leaving strontium oxide; contains 98 p. c. of pure salt. *Assay:* 0.5 Gm. + distilled water 100 Cc. + 25 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. + 5 Cc. nitric acid and 5 Cc. ferric ammonium sulphate T. S., shaken, should require 1.7–3.1 Cc.  $\frac{\text{N}}{10}$  potassium sulphocyanate V. S.

to produce permanent red tint (corresponding to 98 p. c. of pure salt). *Impurities*: Heavy metals, barium. Should be kept dark, in small, glass-stoppered vials. Dose, gr. 10–30 (.6–2 Gm.).

**PROPERTIES AND USES.**—Alterative. Does not irritate intestinal tract nor depress nutrition; may be substituted for potassium iodide.

**Strontii Salicylas.** **Strontium Salicylate**,  $\text{Sr}(\text{C}_7\text{H}_5\text{O}_3)_2 + 2\text{H}_2\text{O}$ . —Fr. Salicylate de Strontium; Ger. Strontium salicylicum (salicylsaures.)

*Manufacture*: Dissolve salicylic acid (10) in hot water (100), add strontium carbonate (5.34), heat until effervescence ceases, filter, evaporate to crystallization. It is a white, crystalline powder, odorless, sweetish, saline taste, soluble in 18 parts water, 66 alcohol, decomposed by heat into inflammable vapors, phenol odor, and strontium carbonate; contains 98.5 p. c. of pure salt. *Assay*: 0.5 Gm. + sulphuric acid, heated to whiteness, should give residue of strontium sulphate, 0.227 Gm. *Impurities*: Heavy metals, barium. Should be kept cool, dark, in well-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).

**PROPERTIES AND USES.**—Antirheumatic, tonic; rheumatism, gout, chorea, muscular pains, pleurisy, intestinal fermentation.

*Incompatibles*: Ferric salts, lime water, spirit nitrous ether, mineral acids, solutions of quinine salts, lead acetate, silver nitrate, sodium phosphate.

*Allied Salt*:

1. **Strontii Lactas.** **Strontium Lactate**,  $\text{Sr}(\text{C}_3\text{H}_5\text{O}_3)_2 + 3\text{H}_2\text{O}$ .—Obtained by dissolving strontium carbonate in lactic acid until neutralized, evaporate, crystallize— $\text{SrCO}_3 + 2\text{HC}_3\text{H}_5\text{O}_3 = \text{Sr}(\text{C}_3\text{H}_5\text{O}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$ . It is a white granular powder, or in crystalline nodules, odorless, bitter, saline taste, permanent; soluble in 4 parts water, also in alcohol. By heat decomposes into carbonate, which effervesces with HCl. *Impurities*: Barium, carbonate, oxalate, chloride, butyrate, propionate, arsenic, lead, iron, aluminum. *Incompatibles*: Carbonate and sulphate solutions; potassium chromate. Diuretic; nephritis, albuminuria, rheumatism, gout, causes disappearance of the urates. Dose, gr. 10–30 (.6–2 Gm.), ter die.

Some of the unofficial salts, such as nitrate, etc., are used for red fire.

## ALUMINUM.

$$\text{Al}^{\text{III}} = 27.4.$$

The metal aluminum (L. *alumen*, *alumin(is)* + *um*, *alum*, fr. *alo*, to nourish, as confounded with iron sulphate) is the typical representative of the earths and the only one having any medicinal use, the other members being of only scientific interest. It occurs largely in combination with silicic acid in silicated rocks, clays, forming the greater bulk of our earth—basalt, feldspar, granite, hornblend, mica, slate. Clay results from decomposition of these. The valuable minerals



corundum, emery, ruby, and sapphire, are crystals of aluminum oxide colored with other substances. The metal is obtained by decomposing  $\text{Al}_2\text{Cl}_6$  with metallic sodium— $\text{Al}_2\text{Cl}_6 + 6\text{Na} = 2\text{Al} + 6\text{NaCl}$ . It is a very light, silvery-white metal, sp. gr. 2.6, capable of taking a high polish; owing to these properties the metal is used extensively.

*Tests for Aluminum Salts.*—1. Potassium or sodium hydroxide gives white gelatinous precipitate, soluble in excess. 2. Ammonium hydroxide gives a like precipitate, but insoluble in excess. 3. Alkaline carbonates precipitate also the white hydroxide with liberation of  $\text{CO}_2$ . 4. Ammonium sulphide precipitates hydroxide, liberating  $\text{H}_2\text{S}$ . 5. Sodium phosphate precipitates aluminum phosphate, soluble in acids.

**Alumen.** Alum,  $\text{Al}_2\text{K}_2(\text{SO}_4)_2 + 12\text{H}_2\text{O}$ .—(Syn., Potassium Alum, Aluminum and Potassium Sulphate, Sulphas Aluminico-potassicus; Fr. Alun, Sulfate d'Alumine et de Potasse; Ger. Alaun, Kali-Alaun.)

*Manufacture:* 1. Treat aluminum silicate (alum-clay) with  $\text{H}_2\text{SO}_4$ , in order to form aluminum sulphate, to this, in solution, add potassium sulphate, which upon evaporation yields the double salt in crystals.

2. Roast alum-slate or shale (aluminum silicate + iron sulphide) in heaps, the sulphur of the pyrites is oxidized into  $\text{H}_2\text{SO}_4$ ; also aluminum and iron sulphates are formed, which by lixiviation are dissolved out by water. This solution is concentrated, and while hot mixed with  $\text{KCl}$ , which reacts upon the ferric sulphate, giving  $\text{K}_2\text{SO}_4$  and  $\text{Fe}_2\text{Cl}_6$ , this latter remains in solution, while alum separates as a crystalline powder upon cooling. It occurs in large colorless octahedral crystals, or cubes, or crystalline fragments, odorless, sweetish, astringent taste, soluble in 9 parts water, also in warm glycerin, insoluble in alcohol, fuses at  $92^\circ \text{C}$ . ( $198^\circ \text{F}$ .), at  $200^\circ \text{C}$ . ( $392^\circ \text{F}$ .) loses water of crystallization (45.55 p. c.); contains 99.5 p. c. of pure salt. *Impurities:* Heavy metals (iron, etc.), ammonium, alum. Dose, gr. 5–30 (.3–2 Gm.), with sugar, syrup, etc.; emetic, ʒj–2 (4–8 Gm.).

✕. *PREPARATIONS.*—1. *Alumen Exsiccatum.* Dried Alum,  $\text{AlK}(\text{SO}_4)_2$ .—(Syn., Burnt Alum; Br. Exsiccated Alum; Fr. Alun calciné—des-séché—brulé; Ger. Alumen ustum, Gebrannter Kali-Alaun.)

*Manufacture:* Heat alum 100 Gm. until it liquefies and then moderately until it weighs 55 Gm. It is a white granular powder, odorless, sweet, astringent taste, absorbs moisture from air, soluble in 17 parts water; contains at least 99 p. c. of pure anhydrous salt. Should be kept in well-stoppered bottles.

2. *Alumini Hydroxidum.* Aluminum Hydroxide,  $\text{Al}(\text{OH})_3$ .—(Syn., Alumini Hydras, Aluminum Hydrate, Hydrated Alumina; Fr. Hydrate d'Alumine; Ger. Thonerdehydrat, Argilla (Pura) Hydrata.)

*Manufacture:* Dissolve alum 10 Gm., monohydrated sodium carbonate 4.3 Gm., each separately in water 100 Cc., filter, heat to boiling, mix (add alum to sodium), wash precipitate with hot water, drain, dry, powder— $3\text{Na}_2\text{CO}_3 + 2\text{AlK}(\text{SO}_4)_2 + 3\text{H}_2\text{O} = 3\text{Na}_2\text{SO}_4 + \text{K}_2\text{SO}_4 + 2\text{Al}(\text{OH})_3 + 3\text{CO}_2$ . It is a light, white, amorphous powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in hydrochloric

or sulphuric acid, potassium hydroxide T. S., heated to redness loses 34 p. c.; contains 99.5 p. c. of pure salt. *Impurities*: Heavy metals (iron, etc.), sulphate, alkali salts. Dose, gr. 3–6 (.2–.4 Gm.).

*Unoff. Prep.*: *Glycerinum Aluminis* (Br.), 15 p. c.

**PROPERTIES AND USES.**—Astringent, irritant, emetic, purgative; hemorrhage, serous diarrhoea, colliquative sweats, menorrhagia, hæmaturia, gastric intestinal catarrh, dysentery, diabetes, bronchitis, whooping-cough, lead colic, croup, narcotic poisoning, intermittent fever, ophthalmia, ecchymoses, sore throat, aphonia, ingrowing toe-nails, chilblains, ulcers, burns, relaxed gums, uvula, pharynx, vagina, anus, gonorrhoea, gleet, leucorrhoea, toothache. Dried Alum—astringent, stimulant, escharotic, more powerful than the preceding; fungous granulations, ulcers, insufflation. Both are applied locally in powder, lotion, injection, sprays, gargles (3–5 p. c.). Aluminum Hydroxide—resembles medicinally bismuth oxide and magnesium oxide: feebly astringent, desiccant powder, antacid; used externally on skin in inflammations, dyspepsia, diarrhoea, intertrigo, superficial burns.

*Incompatibles*: Alkalies, lime, lead, mercury, iron salts, tartrates, tannin.

*Allied Salt*:

1. *Alumini et Ammonii Sulphas*. *Sulphate of Aluminum and Ammonia*, *Ammonia Alum*.—Official 1860–1870.

Here ammonium sulphate instead of potassium sulphate, as in the present official alum, is added to the solution of aluminum sulphate. This alum is much used now, owing to the cheapness of the ammonium salt used in its manufacture, while in action and appearance it is identical with our official—only recognized as different by chemical tests.

**Alumini Sulphas**. Aluminum Sulphate,  $\text{Al}_2(\text{SO}_4)_3 + 16\text{H}_2\text{O}$ .—(Syn., Fr. Sulfate d'Alumine; Ger. Aluminum sulfuricum, Aluminum-sulfat, Schwefelsaure Thonerde.)

*Manufacture*: Dissolve freshly precipitated aluminum hydroxide in diluted sulphuric acid, crystallize or evaporate to dryness. It is a white crystalline powder, or in shining plates or crystalline fragments, odorless, sweetish, astringent taste, permanent, soluble in 1 part water, insoluble in alcohol, heated to 200° C. (392° F.) loses water of crystallization (45.7 p. c.); contains 99.5 p. c. of pure salt. *Impurities*: Heavy metals (iron, etc.), ammonia, free acids.

**PROPERTIES AND USES.**—Disinfectant, deodorant, antiseptic; leucorrhoea, chronic dysentery, ulcers, cancers, nævi, polypi, fetid discharges, enlarged tonsils, nasal catarrh, diseases of the os uteri, scrofulous sores. Injection (50 p. c.) is of considerable service in preserving subjects for dissection—not so effective as zinc chloride; it is not used internally.

*Allied Product*:

1. **Kaolinum**. Kaolin,  $\text{H}_2\text{Al}_2\text{Si}_2\text{O}_5 + \text{H}_2\text{O}$ , *official*.—(Syn., Terra (Argilla) porcellanea, Porcelain (China) Clay, Fuller's Earth; Fr. Terre à porcelaine; Ger. Porcellanerde, Porcellanthon.)

*Manufacture*: This native aluminum silicate, consisting chiefly of

pure silicate, powdered and freed from gritty particles by elutriation, is found in the earth in large deposits, being the product of the weathering action of carbon dioxide and water on feldspar minerals (potassium aluminum silicate,  $\text{KAlSi}_3\text{O}_8$ ); in this action the potassium silicate formed is removed by rain-water, absorbed by soil and in turn by plants, leaving behind insoluble kaolin. It is a soft, whitish powder or lumps, earthy or clay-like taste, insoluble in water, diluted acids, alkali hydroxides. *Impurities*: Iron, lime (removed by 5 p. c. hydrochloric acid), sand (removed by levigation); non-volatile residue should be 85 p. c.

**PREPARATION.**—1. *Cataplasma Kaolini*. Cataplasm of Kaolin.—(Syn., Fr. Cataplasme de Terre à porcelaine; Ger. Porzellanthonum-schlag.)

*Manufacture*: Heat for 1 hour to  $100^\circ\text{C}$ . ( $212^\circ\text{F}$ .) kaolin (80 powder) 577 Gm., occasionally stirring, mix with boric acid 45 Gm., then with glycerin 375 Gm., finally thymol .5 Gm., dissolved in methyl salicylate 2 Gm., and oil of peppermint .5 Gm.—make homogeneous mass; resembles soft putty.

**PROPERTIES AND USES.**—Drying agent, emollient; to clarify and decolorize vegetable and animal oils, (wine, beer, honey, syrups), dusting powder upon irritated surfaces, sores, etc., excipient for silver nitrate, potassium permanganate, etc.; Cataplasm—counter-irritant, ex-osmotic, antiseptic, its chief virtue depending upon the hygroscopic power of the glycerin; induces superficial hyperæmia, thus relieving deep-seated congestion, pain—pneumonia, pleurisy, bronchitis, peritonitis, sprains, boils, periostitis, mastitis, orchitis, etc. This replaces flaxseed and mustard poultices, liniments, antiphlogistine, etc., and should be applied freely and as hot as can be borne, being heated by placing container in hot water; impaired by exposure.

## CERIUM.

$\text{Ce}^{\text{IV}} = 141$ .

The element cerium (named by Berzelius, 1803, after asteroid *Ceres*, then just discovered, 1801) occurs sparingly in nature, chiefly in cerite, also in gadolinite, allanite, and orthite. Monzanite sand, N. Ca., contains cerite, also silicates or oxides or phosphates of other earthy metals, as zirconium, erbium, thorium. The oxide of thorium gives a bright white light at comparatively low temperature, on which account it is employed in the mantle of the *Welsbach* incandescent burner. Cerium resembles aluminum in chemical behavior, but its salts act medicinally like those of bismuth and silver. The metal itself is chocolate-brown, burning more easily than magnesium, oxidizing readily in moist atmosphere, and forms two oxides—cerous,  $\text{Ce}_2\text{O}_3$ , and ceric,  $\text{CeO}_2$ . We have only one official salt.

*Tests for Cerium Salts*: If to a colorless cerous salt sodium hypochlorite be added, we get a red precipitate, which is soluble in warm

HCl with evolution of chlorine. 2. Any residue, after heating a cerium salt, dissolved in  $\text{H}_2\text{SO}_4$  and strychnine crystal added, gives a deep blue, changing to purple, then red.

**Cerii Oxalas.** Cerium Oxalate,  $\text{Ce}_2(\text{C}_2\text{O}_4)_3 \cdot 9\text{H}_2\text{O}$  +.—(Syn., Cerous Oxalate, Oxalas Cericus; Fr. Oxalate de Cerium; Ger. Cerium Oxalicum, Oxalsäures Ceroxydul, Ceroxalat.)

**Manufacture:** This salt consists chiefly of a mixture of cerium, didymium, and lanthanum oxalates, with other rare earths of this group, and is obtained by decomposing the native silicates by heating with  $\text{H}_2\text{SO}_4$ , dissolving in diluted  $\text{HNO}_3$ , and passing  $\text{H}_2\text{S}$  into the solution to remove copper and allied metals; to the filtered solution HCl is added to retain the calcium salt in solution, and finally oxalic acid, which precipitates the cerite metals as oxalates. This precipitate of oxalates is mixed with magnesium carbonate, then calcined to decompose the oxalates, the residue dissolved in  $\text{HNO}_3$ , and this solution thrown into water containing 0.5 p. c.  $\text{H}_2\text{SO}_4$ . Lanthanum, didymium, and magnesium remain in solution, ceric sulphate being precipitated; the latter is dissolved in  $\text{H}_2\text{SO}_4$ , reduced to cerous sulphate by sodium thiosulphate, and the oxalate precipitated by adding oxalic acid. It is a fine, white powder, odorless, tasteless, permanent, insoluble in water, alcohol, ether, alkali solutions, soluble in hot, diluted sulphuric or hydrochloric acid, heated to redness decomposes into reddish-brown residue of ceric and other rare-earth oxides, constituting 47 p. c. of the salt. **Impurities:** Heavy metals, arsenic, aluminum, zinc, carbonates. Dose, gr. 1–10 (.06–.6 Gm.), ter die, in powder, pill, or water.

**PROPERTIES AND USES.**—Nervous and gastric sedative, similar to bismuth subnitrate; nausea, vomiting of pregnancy, sea-sickness, asthma, uterine disorders, hysteria, dyspepsia, pyrosis, cough of phthisis, bronchitis, chorea.

## FERRUM. IRON.

$$\text{Fe}^{\text{II}} = 55.88. \quad \text{Fe}_2^{\text{VI}} = 111.76.$$

The element iron (AS. *iren*, Goth. *iarn*, metal; L. *ferrum*) is the most useful and abundant of the heavier metals, being present in nearly all rocks, soils, animal and plant ashes, but seldom in the pure state. It occurs as sulphide—iron pyrites,  $\text{FeS}_2$ ; as oxide—magnetic iron ore,  $\text{FeO}$ ,  $\text{Fe}_2\text{O}_3$ ; red hematite,  $\text{Fe}_2\text{O}_3$ ; as carbonate—spathe iron ore,  $\text{FeCO}_3$ , and also combined with mineral acids. From any of these ores the metal may be obtained by reducing with carbon, which consists in heating in a blast furnace iron ore, coke, or coal, and some flux, as limestone or clay. This latter forms a more fusible aluminum and calcium silicate or slag. (1)  $\text{Fe}_2\text{O}_3 + 3\text{C} = 2\text{Fe} + 3\text{CO}$ . (2)  $\text{FeCO}_3 + \text{C} = \text{Fe} + \text{CO}_2 + \text{CO}$ . (3)  $\text{FeS}_2 + \text{O}_4 = \text{Fe} + 2\text{SO}_2$ . As such it is known as cast or pig iron, and is not pure by reason of its containing traces of silicon, sulphur, phosphorus, and carbon, 2–5 p. c. By puddling or refining, the carbon combines with a blast of oxygen and is

blown out, leaving wrought or bar iron, having still present carbon 0.03–0.3 p. c. Steel is a product intermediate between these two, containing carbon 0.5–2 p. c.

Iron is hard, malleable, ductile, tenacious, grayish, fibrous texture; taste slightly styptic, odor slight, magnetic, sp. gr. 7.7, least fusible of all useful metals excepting platinum, readily oxidizes in moisture and forms two kinds of salts, *ferrous* (lower) and *ferric* (higher). The metal itself and many important salts are official.

*Tests for Iron Salts:* 1. Ferrous salt with potassium ferrocyanide gives a nearly white precipitate, turning blue on exposure to air; with ferric salt have deep blue color at once—Prussian blue. 2. Ferrous salt with potassium ferricyanide gives at once deep blue color—Turnbull's blue; with ferric salts have greenish-olive color. 3. Ferrous salt with tannin has no effect; with ferric salt have greenish-black precipitate—ferric tannate (ink). 4. Ammonium sulphide gives black precipitate with both kinds of salts. 5. Ferrous salts with ammonia water give whitish precipitate, turning green, then black, finally brown; with ferric salts have precipitate of brown ferric hydroxide.

**Ferrum. Iron.**—(Syn., Iron wire, Mars; Fr. Fer, Fil de Fer; Ger. Eisen, Eisendraht.) Metallic iron in the form of fine, bright, and non-elastic wire; the grease or paraffin oil used in coating for protection against moisture and oxidation (rust) should be removed previous to use. Wire in form of card teeth wastings is most convenient, purest, and cheapest.

**PREPARATIONS.**—(Unoff.) *Syrupus Ferri Phosphatis* (Br.), each 3j (4 Cc.) contains gr. 1 (.06 Gm.) ferrous phosphate, dose, 3ss–1 (2–4 Cc.). *Vinum Ferri* (Br.), 5 p. c. + sherry wine, dose, 3j–4 (4–15 Cc.).

*Allied Product:*

1. *Ferri Ramenta. Iron Filings.*—Official 1830–1860. Such as are wholly attracted by the magnet. Owing to the magnet not being a perfect purifier, as it attracts and takes up other substances, and owing to so much copper being present in nearly all samples, they are no longer used officially.

**Ferrum Reductum. Reduced Iron.**—(Syn., Quevenne's Iron, Iron reduced by Hydrogen, Iron by Hydrogen, Powder of Iron, Ferrum Hydrogenio Reductum, Ferrum Ope Hydrogenii Paratum; Br. Ferrum Redactum; Fr. Fer réduit par l'Hydrogène; Ger. Reduzirtes Eisen.)

*Manufacture:* Freshly prepared ferric hydroxide (or subcarbonate), thoroughly washed and dried, is put into the central portion of a glass tube, the ends being filled with asbestos and corked, each cork being perforated by a smaller glass tube; the tube is put into a furnace and brought to red heat. Through this tube is now passed pure dry hydrogen, made from zinc and  $H_2SO_4$ , which is continued until furnace and tube have cooled— $Fe_2O_3 + 6H + \text{heat} = 2Fe + 3H_2O$ . It is a very fine, grayish-black, lustreless powder, odorless, tasteless, permanent,

insoluble in water, alcohol; contains 90 p. c. of pure metallic iron. *Assay*: 0.555 Gm. + iodine 2.6 Gm. + water 6 Cc. + potassium iodide 2 Gm.; after rotating set aside for 1 hour, add distilled water q. s. 100 Cc.; to 25 Cc. of this add  $\frac{N}{10}$  sodium thiosulphate V. S., until last trace of brown color discharged, divide weight of iodine taken by 0.02518, subtract from quotient twice the number of Cc. used of V. S., the remainder = p. c. of metallic iron present. *Impurities*: Arsenic, sulphide. Dose, gr. 1–5 (.06–.3 Gm.), at meal-time, in pill, wafer.

**PREPARATION.**—(Unoff.) *Trochiscus Ferri Redacti* (Br.), each contains 1 gr. (.06 Gm.).

**PROPERTIES AND USES.**—Originally this was prepared as a substitute for the ferri subcarbonas, by Quevenne, of Paris. It is a chalybeate tonic, but very prone to derange the stomach, owing to formation of  $H_2S$  from the impurities.

**Liquor Ferri Chloridi. Solution of Ferric Chloride.**—(Syn., Liquor Ferri Muriatici Oxydati, Ferrum Sesquichloratum Solutum; Br. Liquor Ferri Perchloridi Fortis; Fr. Soluté de Perchlorure de Fer, Chlorure ferrique liquide; Ger. Liquor Ferri sesquichlorati, (Flüssiges) Eisenchloridlösung.)

*Manufacture*: To a flask containing iron wire 12.5 Gm. add hydrochloric acid 42 Gm. diluted with distilled water 25 Cc., heat on water-bath until effervescence ceases ( $1\frac{1}{2}$  hours), boil, filter, rinse flask and iron wire with little distilled water; to filtered liquid, including rinsings, add hydrochloric acid 22 Gm. and this mixture in a slow stream to nitric acid 6.5 Gm., warm gently; after effervescence ceases, heat until free from nitric acid; if solution black add nitric acid in drops until red fumes no longer escape, finally add hydrochloric acid 4 Gm., and distilled water q. s. 100 Gm. It is a reddish-brown aqueous solution of ferric chloride,  $FeCl_3$ , faint odor of hydrochloric acid, acid, styptic taste, acid reaction, sp. gr. 1.315; contains 29 p. c. of anhydrous salt, corresponding to 10 p. c. of metallic iron. *Assay*: 10 Gm. + water q. s. 100 Cc., of this 11.1 Cc. + water 10 Cc. + hydrochloric acid 2 Cc. + potassium iodide 1 Gm., after heating half an hour at  $40^\circ C.$  ( $104^\circ F.$ ), cooling, and mixing with few drops starch T. S., should require 20 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S., to discharge blue or greenish color (each Cc. of V. S. indicating 0.5 p. c. of metallic iron). *Impurities*: Zinc, copper, salts of fixed alkalies, ferrous salts, oxychloride, nitric acid. Dose,  $\mathfrak{M}$ j–10 (.13–.6 Cc.), well diluted with water or syrup.

**PREPARATIONS.**—1. *Ferri Chloridum.* Ferric Chloride,  $Fe_2Cl_6 \cdot 12H_2O$ . (Syn., Sesquichloride (Perchloride) of Iron, Ferrum Muriaticum Oxydatum, Ferri Perchloridum; Fr. Perchlorure de Fer, Chlorure ferrique; Ger. Ferrum sesquichloratum, Eisenchlorid.)

*Manufacture*: Evaporate on water-bath solution of ferric chloride 100 Gm. until it weighs 40 Gm., set aside to crystallize, break into pieces. It is in orange-yellow crystalline pieces, odorless or faint odor

of hydrochloric acid, strongly styptic taste, very deliquescent, soluble in water, alcohol, fuses at  $35.5^{\circ}\text{C}$ . ( $96^{\circ}\text{F}$ .) to reddish-brown liquid, at higher temperature decomposes, leaving residue of ferric oxide; contains 22 p. c. of metallic iron in form of chloride. *Assay*: Dissolve 1 Gm. in water q. s. 100 Cc., of this 55.5 Cc. + hydrochloric acid 3 Cc. + potassium iodide 2 Gm., after heating half an hour at  $40^{\circ}\text{C}$ . ( $104^{\circ}\text{F}$ .), should require upon cooling 22 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. for complete decolorization (each Cc. of V. S. indicating 1 p. c. of metallic iron). *Impurities*: Heavy metals, ferrous salt, nitric acid. Should be kept dark, in glass-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.).

2. *Tinctura Ferri Chloridi*. Tincture of Ferric Chloride. (Syn., *Tinctura Ferri (Muriatis) Sesquichloridi*; Br. *Tinctura Ferri Perchloridi*; Fr. *Teinture de Perchlorure de Fer*; Ger. *Eisenchlorid-tinktur*.)

*Manufacture*: Solution of ferric chloride 25 Cc., alcohol q. s. 100 Cc.; mix and let stand 3 months in covered vessel. It is a bright, brownish hydro-alcoholic solution of  $\text{FeCl}_3$ , containing 13.28 p. c. of anhydrous salt, corresponding to 4.6 p. c. of metallic iron, odor slightly ethereal, astringent, styptic taste, acid reaction, sp. gr. 0.960. *Assay and Impurities*: About the same as liquor ferri chloridi. Should be kept dark, in glass-stoppered bottles. Dose,  $\text{Mx}$ –30 (.6–2 Cc.), well diluted with water.

Prep.: 1. *Liquor Ferri et Ammonii Acetatis*. Solution of Iron and Ammonium Acetate. (Syn., *Mistura Ferri et Ammonii Acetatis*, Basham's Mixture.)

*Manufacture*: To solution of ammonium acetate 50 Cc., which should not be alkaline, add successively diluted acetic acid 6, tincture of ferric chloride 4, aromatic elixir 12, glycerin 12, water q. s. 100 Cc. This should be made freshly when wanted, as it deteriorates by age. Dose,  $\text{3j}$ –4 (4–15 Cc.), diluted.

*Unoff. Prep.*: *Liquor Ferri Perchloridi* (Br.), solution ferric chloride 25 Cc., water q. s. 100 Cc., dose,  $\text{Mx}$ –30 (.6–2 Cc.).

PROPERTIES AND USES.—*Liquor Ferri Chloridi*—styptic, when injected into vessels coagulates blood; used to cure varices, hemorrhages, incontinence of urine, vesical catarrh, leucorrhœa, injection for aneurism, nasal polypi, erectile tumors; externally in varicose veins, hemorrhoids, vascular growths, ulcers, cancers, diphtheria, ophthalmia, chilblains, ingrown nails, ulcerated gums, gangrene, hydrocele, prolapsed rectum, sweating of the feet. *Ferri Chloridum*—powerful astringent, hæmostatic; chiefly used locally for stanching hemorrhage, as in epistaxis, hæmoptysis—by inhaling an atomized solution, leech-bites, on gums after teeth extracted, uterine ulcers, lupoid skin diseases. *Tinctura Ferri Chloridi*—tonic in scrofula, diuretic; gonorrhœa, gleet, leucorrhœa, dysury, hemorrhages from uterus, kidneys, bladder, erysipelas, scarlatina, diphtheria, purulent infection of the blood, venereal warts, cancerous, fungous ulcers, injection in aneurisms, sweats, puerperal fever, chilblains, poisoning by rhus toxicodendron, acute articular rheu-

matism. *Liquor Ferri et Am. Acetatis*—albuminuria, chronic Bright's disease. The astringency of these preparations can be neutralized with sodium bicarbonate or citrate. They as well as all other acid preparations should be taken through a glass tube, to prevent the liquids coming into contact with the teeth. If this be impossible at times, the mouth should then be rinsed well with water in which an alkali has been dissolved.

*Allied Product:*

1. *Ferrum Dialysatum. Dialyzed Iron*.—Obtained by saturating aqueous solution of ferric chloride with fresh ferric hydroxide, putting into a dialyzer and suspending in water; all the acid passes through the septum, but very little iron. Used like *tinctura ferri chloridi*, with the advantages of having no styptic taste, not staining teeth, nor constipating. Dose,  $\mathfrak{M}\nu$ -30 (.3-2 Cc.), diluted with water.

*Syrupus Ferri Iodidi. Syrup of Ferrous Iodide*.—(Syn., Fr. *Sirop d'Iodure de Fer*; Ger. *Sirupus Ferri jodati, Eisenjodürsirup*.)

*Manufacture*: Mix iron, as fine bright wire, 1.25 Gm., distilled water 15 Cc., iodine 4.15 Gm., shake occasionally until green color appears, heat to boiling, add sugar 5 Gm., when dissolved filter solution into sugar 55 Gm., rinse iron wire with distilled water 12.5 Cc., filter into sugar, heat and stir until solution affected, strain, add diluted hypophosphorous acid 2 Cc., and distilled water q. s. 100 Gm. It is a transparent, pale green, syrupy liquid, odorless, sweet, strongly ferruginous taste, neutral reaction, sp. gr. 1.349; contains 5 p. c. by weight of ferrous iodide,  $\text{FeI}_2$ , or 6.74 Gm. in 100 Cc. *Assay*: 10 Gm. + distilled water q. s. 100 Cc., of this 15.4 Cc., + water 15 Cc. + 6 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. + 2 Cc. each of diluted nitric acid and ferric ammonium sulphate T. S., after shaking 1 Cc.  $\frac{\text{N}}{10}$  potassium sulphocyanate V. S. should be required to produce permanent reddish-brown tint (each Cc. of  $\frac{\text{N}}{10}$  silver nitrate V. S. consumed corresponding to 1 p. c. of ferrous iodide). *Impurities*: Free iodine, etc. Dose,  $\mathfrak{M}\chi$ -40 (.6-2.6 Cc.), in water, after meals.

*Pilulæ Ferri Iodidi. Pills of Ferrous Iodide*.—(Syn., Fr. *Pilules d'Iodure de Fer (ferreuse)*, *Pilules de Blancard*; Ger. *Eisenjodürpillen*.)

*Manufacture*: To reduced iron 4 Gm. add water 6 Cc., then gradually iodine 5 Gm., triturating until red tint disappears; now add previously mixed glycyrrhiza (root) 4 Gm., sugar 4, extract of glycyrrhiza 1, acacia 1, evaporate with constant stirring to pilular consistence, make into 100 pills; dissolve balsam of tolu 10 Gm. in ether 15 Cc., in this shake pills until coated, roll on plate until dry. Should be devoid of iodine smell; when triturated with water, filtered liquid should not assume more than a light blue tint with starch T. S. (abs. of more than trace of free iodine). Should be kept in well-stoppered bottles. Dose, 1-2 pills.

**PROPERTIES AND USES.**—All of the iodide of iron preparations are



tonic, alterative, diuretic, emmenagogue; scrofula, anæmia from scrofula; tuberculosis, secondary syphilis, skin affections, chronic rheumatism, amenorrhœa, leucorrhœa, swollen glands, etc.

*Allied Products:*

1. *Ferri Iodidum Saccharatum. Saccharated Ferrous Iodide.*—Obtained by mixing iron, as fine bright wire, 6 Gm., iodine 17, distilled water 20 Cc. shaking occasionally until green color appears, filtering into sugar of milk 40 Gm., evaporating to dryness with constant stirring, then adding reduced iron 1 Gm. to retard decomposition, and milk-sugar q. s. 100 Gm. It is a yellowish-white powder, very hygroscopic, odorless, sweet, ferruginous taste, soluble in 7 parts water, partially soluble in alcohol. *Impurities:* Salts of fixed alkalis, free iodine. Should be kept cool, in the dark, in dried, well-stoppered bottles. May be made by simply evaporating *Syrupus Ferri Iodidi*, but on the continued application of heat a part of the iodine would be liberated, and a darker, less soluble, product result, through the formation of ferric oxide. Dose, gr. 1–5 (.06–.3 Gm.) ter die.

2. *Ferri Lactas. Ferrous Lactate*,  $\text{Fe}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$ .—Obtained by digesting iron filings 15 Gm. in lactic acid 30 Cc. + water 500 Cc. until action ceases, filtering, crystallizing, or by double decomposition between ferrous sulphate and calcium lactate. It is in pale greenish-white crusts of small needle-like crystals, slightly peculiar odor, mild, sweetish, ferruginous taste, soluble in 40 parts water, insoluble in alcohol. *Impurities:* Metals, sulphate, chloride, citrate, tartrate, malate, sugar, gum, butyric acid, carbonizable substances. Chalybeate, tonic. Dose, gr. 1–5 (.06–.3 Gm.), pill, lozenge, bread, water, syrup.

**Ferri Sulphas. Ferrous Sulphate**,  $\text{FeSO}_4 + 7\text{H}_2\text{O}$ .—(Syn., Green Vitriol, Copperas, Sulfas Ferrosus, Ferrum Vitriolatum Purum, Vitriolum Martis Purum; Fr. Sulfate (Protosulfate) de Fer, Sulfate ferreux; Ger. Ferrum sulfuricum, Ferrosulfat, Schwefelsaures Eisenoxydul.)

FIG. 453.



Ferrous sulphate crystal.

*Manufacture:* Dissolve iron wire in diluted sulphuric acid by the aid of heat, evaporate, crystallize— $\text{Fe}_2 + 2\text{H}_2\text{SO}_4 = 2\text{FeSO}_4 + \text{H}_2$ . It is in large pale bluish-green monoclinic prisms, odorless, saline, styptic taste, efflorescent in dry air, while in moist air crystals rapidly absorb oxygen, becoming coated with brownish-yellow basic ferric sulphate, soluble in 0.9 part water, insoluble in alcohol, heated slowly to  $115^\circ \text{C}$ . ( $239^\circ \text{F}$ .) crystals fall to powder, losing 38.87 p. c., by weight ( $6\text{H}_2\text{O}$ ); contains 99.5 p. c. of pure uneffloresced salt. *Assay:* 1.38 Gm. + 25 Cc. diluted sulphuric acid should require 49.75 Cc.  $\frac{\text{N}}{10}$  potassium permanganate V. S. (each Cc. of V. S. indicating 2 p. c. crystallized ferrous sulphate). *Impurities:* Heavy metals, alkali metals, free acid. Should be kept in well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.).

PREPARATIONS.—1. *Ferri Sulphas Exsiccatus*. Exsiccated Ferrous Sulphate,  $2\text{FeSO}_4 + 3\text{H}_2\text{O}$ . (Syn., Dried Sulphate of Iron; Fr. Sulfate (ferreux) de Fer desséché; Ger. Ferrum sulfuricum siccum, Getrocknetes Ferrosulfat, Entwässertes (Schwefelsaures Eisenoxydul) Ferrosulfat.)

*Manufacture*: Ferrous sulphate 100 Gm. + heat,  $40^\circ\text{C}$ . ( $104^\circ\text{F}$ .), in dry air until effloresced, then on water-bath with constant stirring until powder weighs 64–65 Gm.; reduce to fine powder. It is a grayish-white powder, slowly but completely soluble in water. Should be kept in dry, well-stoppered bottles. Dose, gr.  $\frac{1}{2}$ –3 (.03–.2 Gm.).

Prep.: 1. *Pilulæ Aloes et Ferri*, 1 gr. (.06 Gm.) in each pill.

2. *Ferri Sulphas Granulatus*. Granulated Ferrous Sulphate,  $\text{FeSO}_4 + 7\text{H}_2\text{O}$ . (Syn., Ferri Sulphas Præcipitatus; Fr. Sulfate ferreux précipité; Ger. Præcipitirtes Ferrosulfat.)

*Manufacture*: Dissolve ferrous sulphate 100 Gm. in boiling distilled water 100 Cc., add diluted sulphuric acid 5 Cc., filter, evaporate to 150 Gm., cool quickly with constant stirring, when it will crystallize, drain crystals, pour upon them alcohol 25 Cc., drain, dry quickly; the acid prevents oxidization of the ferrous sulphate, the alcohol removes acid and uncombined water, hence facilitates drying. It is a pale bluish-green crystalline powder, responding to tests for ferri sulphas. Should be kept in dry, well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.).

Prep.: 1. *Pilulæ Ferri Carbonatis*,  $2\frac{1}{2}$  gr. (.16 Gm.).

3. *Mistura Ferri Composita*,  $\frac{3}{4}$  p. c.

PROPERTIES AND USES.—Astringent, chalybeate, disinfectant. Overdoses cause nausea, vomiting, griping, purging, gastric inflammation; often not dissolved, thus causing impaction, which is best relieved by saline cathartics; hemorrhages, colliquative sweats, leucorrhœa, gleet, chronic diarrhœa, gastric catarrh, ulcers. With aloes relieves constipation. Externally—in ophthalmia, erysipelas. Ointment (dried sulphate 1 + lard 20) useful in skin diseases (eczema, intertrigo, impetigo), syphilitic and scrofulous sores.

*Allied Salt*:

1. *Ferri Oxalas*. *Ferrous Oxalate*,  $\text{FeC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ .—Official 1880–1890. Obtained by dissolving ferrous sulphate 62 Gm. in water 1,000 Cc., also oxalic acid 28 Gm. in water 500 Cc., filter and mix two solutions with agitation, wash and dry precipitate. It is a yellow crystalline powder, odorless, nearly tasteless, permanent, slightly soluble in water, soluble in HCl or hot diluted  $\text{H}_2\text{SO}_4$ . Dose, gr. 1–5 (.06–.3 Gm.).

PROPERTIES AND USES.—Very similar to those of all other ferruginous compounds, but weak, hence little used.

*Liquor Ferri Subsulphatis*. *Solution of Ferric Subsulphate*.—(Syn., Solution of Basic Ferric Sulphate, Monsel's Solution, Solution of Persulphate (improperly) of Iron; Fr. Liqueur hémostatique de Monsel; Ger. Basisch-Schwefelsaure Eisenoxydlösung, Monselsche Eisenlösung.)

**Manufacture:** Add sulphuric acid 6.5 Gm. to distilled water 50 Cc., heat, add nitric acid 7 Gm.; divide ferrous sulphate 67.5 Gm. into four portions, and add one at a time to the hot liquid, stirring after each until effervescence ceases; if after ferrous sulphate is dissolved the solution is black, add nitric acid by drops with heating and stirring until red fumes cease to be evolved, boil to free of nitric acid, add distilled water q. s. 100 Gm., filter. It is a dark reddish-brown liquid of variable chemical composition, odorless or nearly so, acid, strongly styptic taste, acid reaction, sp. gr. 1.548, miscible with water and alcohol; contains amount of basic ferric sulphate ( $\text{Fe}_2\text{O}(\text{SO}_4)_3$ ?), corresponding to 13.57 p. c. of metallic iron. **Test:** 1. Mix 2 volumes with 1 volume sulphuric acid, when a semi-solid white mass separates on standing (dif. from tersulphate). **Assay:** 10 Gm. + water q. s. 100 Cc., of this 11.1 Cc. + 10 Cc. water + 2 Cc. hydrochloric acid + 1 Gm. potassium iodide, heated half an hour at  $40^\circ\text{C}$ . ( $104^\circ\text{F}$ .), cooled, mixed with few drops starch T. S., should require 27.2 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to discharge blue or greenish color of the liquid (each Cc. of V. S. indicating 0.5 p. c. of metallic iron). **Impurities:** Nitric acid, ferrous salt. Dose, Mij-10 (.2-6 Cc.), well diluted. When physicians order solution of persulphate of iron, this preparation should be dispensed.

**PROPERTIES AND USES.**—Owing to its deficiency in  $\text{H}_2\text{SO}_4$ , this solution when evaporated yields a salt less irritating than the liquor tersulphatis, and one having greater astringency. It was introduced in 1857 by M. Monsel to coagulate blood, hence of use in hemorrhages from cuts, wounds, where irritation is to be avoided, chancre, hæmoptysis, diarrhœa, hemorrhages from stomach, bowels, etc.

**Liquor Ferri Tersulphatis. Solution of Ferric Sulphate.**—(Syn., Solution of Persulphate of Iron, Solution of Normal Ferric Sulphate; Br. Liquor Ferri Persulphatis; Fr. Persulfate de Fer liquide; Ger. Flüssiges Schwefelsaures Eisenoxyd, Liquor Ferri Sulfurici Oxydati.)

**Manufacture:** Add sulphuric acid 9.6 Gm. to distilled water 25 Cc., heat, add nitric acid 5.6 Gm.; divide ferrous sulphate 50 Gm. into four equal portions, and add one at a time to the hot liquid, stirring after each until effervescence ceases; if after ferrous sulphate is dissolved the solution is black, add nitric acid by drops, with heating and stirring, until red fumes cease to be evolved, boil to free of nitric acid, add distilled water q. s. 100 Gm., filter— $6(\text{FeSO}_4 + 7\text{H}_2\text{O}) + 3\text{H}_2\text{SO}_4 + 2\text{HNO}_3 = 3\text{Fe}_2(\text{SO}_4)_3 + 2\text{NO} + 46\text{H}_2\text{O}$ , thus showing formation of normal salt, which is not formed in the preceding liquor. It is a dark reddish-brown aqueous liquid, almost odorless, acid, strongly styptic taste, acid reaction, sp. gr. 1.432, miscible with water and alcohol; contains 36 p. c. of normal ferric sulphate,  $\text{Fe}_2(\text{SO}_4)_3$ , corresponding to 10 p. c. of metallic iron. **Test:** 1. Mix 2 volumes with 1 volume sulphuric acid, when no solid, white mass should separate on standing (dif. from subsulphate). **Assay:** 1.11 Gm. + 15 Cc. water + 2 Cc.

HCl + 1 Gm. KI; keep at 40° C. (104° F.) for 30 minutes, cool, add few drops starch T. S., should require 20 Cc.  $\frac{N}{10}$  sodium thio-sulphate V. S. to discharge blue or greenish color of the liquid (each Cc. of V. S. indicating 0.5 p. c. of metallic iron). *Impurities*: Nitric acid, ferrous salt.

**PROPERTIES AND USES.**—May use cautiously like preceding, but is more irritating, less astringent, externally may cause sloughing sores owing to contained acid; its greatest service is that it forms the basis of our scale salts, also some other iron compounds.

**Ferri et Ammonii Sulphas.** • **Ferric Ammonium Sulphate**,  $\text{FeNH}_4(\text{SO}_4)_2 + 12\text{H}_2\text{O}$ .—(Syn., Ammonio-ferric Sulphate, Ammonio-ferric Alum, Alumen Ammoniacale Ferricum, Ferrum Ammonio Sulphuricum; Fr. Sulfate de Fer et d'Ammoniaque, Alun de Fer ammoniacal; Ger. Ferrum-sulfuricum oxydatum ammoniatum, Schwefelsaures Eisenoxyd-Ammonium, Ammoniakalischer Eisenalaun.)

*Manufacture*: Heat until dissolved solution of ferric sulphate 1,000 Cc. + ammonium sulphate 140 Gm., setting aside to crystallize; wash and dry crystals quickly. It is in pale violet octahedral crystals, odorless, acid, styptic taste, efflorescent, soluble in 2.7 parts water, insoluble in alcohol; contains 99.5 p. c. of pure uneffloresced ferric ammonium sulphate, and 11.5 p. c. of metallic iron. *Assay*: Same as ferric citrate, except 0.555 Gm. should require 11.5 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to discharge color of liquid (each Cc. of V. S. indicating 1 p. c. of metallic iron). *Impurities*: Aluminum, chlorides. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–10 (.3–.6 Gm.), ter die.

**PROPERTIES AND USES.**—Astringent, styptic; hemorrhages, leucorrhœa, chronic mucous fluxes of bowels, vagina, bronchi.

**Ferri Citras.** **Ferric Citrate**,  $\text{Fe}_2(\text{C}_6\text{H}_5\text{O}_7)_3 \cdot 6\text{H}_2\text{O}$ .—(Syn., Citras Ferricus; Fr. Citrate de Sesquioxyde de Fer, Citrate ferrique; Ger. Ferrum citricum oxydatum, Ferricitrat, Citronensaures Eisenoxyd, Eisencitrat.)

*Manufacture*: Solution of ferric citrate 100 Gm., evaporate on water-bath at 60° C. (140° F.) to the consistence of syrup, and spread on glass plates to dry in scales; yield 42.5 Gm. It is in thin, transparent, garnet-red scales, odorless, slight ferruginous taste, soluble in water, insoluble in alcohol; when heated chars into ferric oxide, which moistened with hot water should not show alkaline reaction (abs. of citrates, tartrates of alkali metals); with potassium ferrocyanide T. S. the aqueous solution yields bluish-green color or precipitate, rendered dark blue with hydrochloric acid (dif. from iron and ammonium citrate); contains pure salt corresponding to 16 p. c. of metallic iron. *Assay*: 0.555 Gm. + 15 Cc. water, + 2 Cc. HCl, + 1 Gm. KI, after heating half an hour at 40° C. (104° F.), should require after cooling 16 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to discharge color of liquid, using starch T. S. indicator (each Cc. of V. S. indicating 1 p. c. of metallic iron). *Impurities*: Alkali citrates, tartrates. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Mild tonic for delicate stomachs and children; may be taken fasting or with food.

**Ferri et Quininæ Citras. Iron and Quinine Citrate.**—(Syn., Citras Ferrico-quinicus; Fr. Citrate de Fer et de Quinine; Ger. Chininum ferro-citricum, Eisenchinincitrat, Citronensaures Eisen-chinin, Ferri-chinin Citrat.)

**Manufacture:** Ferric citrate 85 Gm., dissolve with heat in distilled water 160 Cc., to this add quinine (dried) 12 Gm. + citric acid 3 Gm., previously triturated with distilled water 20 Cc.; stir until dissolved, evaporate to syrup, dry on glass. It is in thin, transparent, reddish-brown scales, odorless, bitter, ferruginous taste; soluble in water, becoming less so by age, partially in alcohol, deliquescent; contains 11.5 p. c. of dried quinine, and ferric citrate corresponding to 13.5 p. c. of metallic iron. **Assay:** Quinine: Dissolve 1.11 Gm. in 20 Cc. water + heat, cool, put into a separator + 5 Cc. ammonia water + chloroform 10 Cc.; shake, allow liquid to separate, draw off chloroform layer, shake twice again with chloroform 10 Cc. each time, mix solutions, evaporate; residue should weigh 0.1276 Gm. (corresponding to 11.5 p. c. of dried quinine). Iron: Heat aqueous solution, from which quinine has been removed, on water-bath, until chloroform and ammonia are dissipated, cool, add water q. s. 50 Cc.; now 25 Cc. of this + 3 Cc. hydrochloric acid + 1 Gm. potassium iodide heated half an hour at 40° C. (104° F.), should require upon cooling 13.5 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to discharge color of liquid, using starch T. S. indicator (each Cc. of V. S. indicating 1 p. c. of metallic iron). **Impurities:** Citrates, tartrates of alkali metals. Should be kept dark, in well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

**PROPERTIES AND USES.**—Ferruginous tonic; anæmia, etc.

**Ferri et Quininæ Citras Solubilis. Soluble Iron and Quinine Citrate.**—(Syn., Fr. Citrate de Fer et de Quinine soluble; Ger. Lösliches Eisenchinincitrat.)

**Manufacture:** Ferric citrate 85 Gm., dissolve by heat in distilled water 160 Cc., add quinine (dried) 12 Gm. + citric acid 3 Gm. previously triturated with distilled water 20 Cc.; stir until dissolved, then add, constantly stirring, ammonia water 50 Cc., when the liquid turns greenish-yellow, evaporate to syrup, dry on glass. It is in thin, transparent, greenish or yellowish scales, odorless, bitter, ferruginous taste, deliquescent, soluble in water, partially in alcohol. Corresponds in tests, assay, strength, etc., to preceding. Should be kept dark, in well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.), in pill or solution, before meals.

**PREPARATION.**—1. *Vinum Ferri Amarum.* Bitter Wine of Iron. (Syn., Fr. Vinum de Cinchona Martiatum, Vin (Cenolé) de Quinquina ferrugineux; Ger. Chinaeisenwein, Bitter Eisenwein, Vinum Chinæ Ferratum.)

**Manufacture:** Dissolve soluble iron and quinine citrate 5 Gm. in

white wine 50 Cc., add tincture of sweet orange-peel 6, syrup 30, white wine q. s. 100 Cc., filter after several days in a well-covered funnel. Dose, ʒj-2 (4-8 Cc.).

**PROPERTIES AND USES.**—Tonic; combines the properties of both ingredients in convenient form; taken preferably in pills. Wine—mild ferruginous tonic; anæmia, debility.

**Ferri Phosphas Solubilis. Soluble Ferric Phosphate.**—(Syn., Ferri Phosphas, Ferri et Sodii Citro-phosphas, Ferrum Phosphoricum cum Natrio Citrico, Sodio-ferric Citro-phosphate; Fr. Citro-phosphate de Fer et de Soude; Ger. Natriumferricitrophosphat.)

**Manufacture:** Ferric citrate 50 Gm., dissolve by heat in distilled water 100 Cc., to this add sodium phosphate (uneffloresced) 55 Gm., stirring until dissolved, evaporate to syrup, dry on glass. It is in thin, bright green, transparent scales, odorless, acid, saline taste, darkens with age, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 12 p. c. of metallic iron. **Tests:** 1. Boiled with potassium hydroxide T. S. gives brownish-red precipitate; to filtrate add HCl + magnesia mixture T. S. + ammonia water in excess, get white precipitate turning yellow with silver nitrate T. S. **Assay:** Same as for ferric citrate, except that 12 Cc.  $\frac{N}{10}$  sodium thiosulphate T. S. are required to discharge the color (each Cc. of V. S. indicating 1 p. c. of metallic iron). Should be kept dark, in well-stoppered, amber-colored bottles. Dose, gr. 3-10 (.2-.6 Gm.).

**PREPARATIONS.**—1. *Elixir Ferri, Quininae et Strychninae Phosphatum.* Elixir of the Phosphates of Iron, Quinine and Strychnine. (Syn., Elixir Roborans; Ger. Elixir von Phosphorsäuren Eisen, Chinin und Strychnin.)

**Manufacture:** Dissolve quinine 8.75 Gm., strychnine 0.275 Gm. in alcohol 60 Cc., add phosphoric acid 2 Cc., aromatic elixir 350 Cc.; add acetic acid 28.65 Gm. to ammonium carbonate 9 Gm., neutralize with ammonia water and add distilled water q. s. 50 Cc., mix solutions, add aromatic elixir q. s. 885 Cc.; dissolve soluble ferric phosphate 17.5 Gm. in distilled water 30 Cc. with heat, add aromatic elixir q. s. 120 Cc., mix two solutions, filter. Dose, ʒj-2 (4-8 Cc.).

2. *Glyceritum Ferri, Quininae et Strychninae Phosphatum.* Glycerite of the Phosphates of Iron, Quinine and Strychnine. (Syn., Fr. Glycéré des Phosphates de Fer, Quinine et de Strychnine; Ger. Eisen-, Chinin-, und Strychninphosphat-Glycerit.)

**Manufacture:** Heat soluble ferric phosphate 8 Gm. with water 20 Cc. to 70° C. (158° F.) until dissolved, add phosphoric acid 20 Cc., strychnine .08 Gm., quinine 10.4 Gm., water q. s. 50 Cc., stir, mix solution with glycerin 50 Cc., filter. Dose, ℥xv-60 (1-4 Cc.).

**Prep.:** 1. *Syrupus Ferri, Quininae et Strychninae Phosphatum.* Syrup of the Phosphates of Iron, Quinine and Strychnine. (Syn., Syrupus Eatoni, Eaton's Syrup, Aitkin's Syrup, Syrup of the Three Phosphates, Syrup of Triple Phosphates, Syrupus Ferri Phosphorici cum Chinino et Strychnino; Fr. Sirup tonique d'Eaton; Ger. Eaton's Sirup.)

*Manufacture*: Mix glycerite of the phosphates of iron, quinine and strychnine 25 Cc. with syrup q. s. 100 Cc., strain. Dose, ʒj-2 (4-8 Cc.).

**PROPERTIES AND USES.**—Good chalybeate; owing to acceptable taste may be given in any form. Elixir, glycerite and syrup—food-tonic.

**Ferri Pyrophosphas Solubilis. Soluble Ferric Pyrophosphate.**—(Syn., Ferri Pyrophosphas, Pyrophosphate of Iron with Sodium (Ammonium) Citrate, Sodio-ferric Citro-pyrophosphate, Pyrophosphas Ferricus cum Citrate Sodico, Ferrum Pyrophosphoricum cum Ammonio Citrico; Fr. Citro-pyrophosphate de Fer et de Soude; Ger. Pyrophosphorsaures Eisenoxyd mit Citronensaurem Natron.)

*Manufacture*: Ferric citrate 50 Gm., dissolve with heat in distilled water 100 Cc., to this add sodium pyrophosphate 50 Gm., stirring constantly until dissolved; evaporate to syrup, dry on glass. It is in thin apple-green transparent scales, odorless, acid, saline taste, darkens with age, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 10 p. c. of metallic iron. *Tests*: 1. Boiled with potassium hydroxide T. S. gives brownish-red precipitate; to the filtrate add HCl + magnesia mixture T. S. + ammonia water in excess, get no precipitate (dis. from and abs. of ferric phosphate). *Assay*: Same as for ferric citrate except that 10 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. are required to discharge the color (each Cc. of V. S. indicating 1 p. c. of metallic iron). Should be kept dark, in well-stoppered, amber-colored bottles. Dose, gr. 1-5 (.06-.3 Gm.).

**PROPERTIES AND USES.**—Good chalybeate; anæmia, etc.

**Ferri et Ammonii Citras. Iron and Ammonium Citrate.**—(Syn., Ammonio-ferric Citrate, Ferro-ammonium Citricum, Soluble Citrate of Iron; Fr. Citras Ammonico-ferricus, Citrate de Fer et d'Ammoniaque (de Fer Ammoniacal); Ger. Citronensaures Eisenoxyd Ammonium (Ammoniak), Ferriammoncitrat.)

*Manufacture*: Add solution of ferric citrate 100 Cc. to ammonia water 40 Cc., evaporate mixture at 60° C. (140° F.) to syrup, dry on glass. It is in thin, transparent, garnet-red scales, odorless, saline, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol, chars into ferric oxide, which moistened with hot water should not show alkaline reaction (abs. of citrates, tartrates of alkali metals), not precipitated but darkened by ammonia water; precipitated by potassium hydroxide V. S.; contains amount of salt corresponding to 16 p. c. of metallic iron. *Tests*: 1. With potassium ferrocyanide T. S. get no blue color or precipitate unless HCl added (dif. from ferric citrate). *Assay*: Same as for ferric citrate, except that 16 Cc. of V. S. are required to discharge the color (each Cc. of V. S. indicating 1 p. c. of metallic iron). *Impurities*: Citrates, tartrates of alkali metals. Should be kept dark, in well-stoppered bottles. Dose, gr. 2-5 (.13-.3 Gm.).

**PREPARATIONS.**—1. *Ferri et Strychninæ Citras. Iron and Strychnine Citrate.* (Syn., Fr. Citrate de Fer et de Strychnine; Ger. Citronensaures Eisen-Strychnin.)

**Manufacture:** Iron and ammonium citrate 98 Gm., dissolve in distilled water 100 Cc., strychnine 1 Gm. + citric acid 1 Gm., dissolve in distilled water 20 Cc., mix, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red to yellowish-brown scales, odorless, bitter, ferruginous taste, deliquescent, soluble in water, partially in alcohol; contains 0.9–1 p. c. of strychnine and amount of salt corresponding to 16 p. c. of metallic iron; chars into ferric oxide, which should not be alkaline (abs. of citrates, tartrates of alkali metals). **Assay:** Strychnine: Dissolve 4.44 Gm. in a separator with 15 Cc. water, add 5 Cc. ammonia water + 10 Cc. chloroform, shake, draw off chloroform layer, shake twice more, each time with 10 Cc. chloroform, mix chloroform solutions, allow to evaporate at 100° C. (212° F.) until dry; this residue should weigh 0.04–0.0444 Gm. (corresponding to 0.9–1 p. c. of strychnine). Iron: Heat the aqueous liquid, from which the strychnine has been removed, on water-bath until all chloroform and ammonia odors are dissipated, cool, add water q. s. 100 Cc.; now take of this 25 Cc., add 4 Cc. hydrochloric acid + 1 Gm. potassium iodide, heat for half an hour at 40° C. (104° F.), when cool should require 32 Cc.  $\frac{N}{10}$  sodium thiosulphate V. S. to discharge color, using starch T. S. indicator (each Cc. V. S. indicating  $\frac{1}{2}$  p. c. of metallic iron). Should be kept dark, in well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.), in pill or solution.

2. *Vinum Ferri*. Wine of iron. (Syn., *Vinum Ferri Citratis*, U. S. P. 1890; Fr. *Vinum Chalybeatum*, *Vin chalybé*, *Vin (CEnolé)* ferrugineux; Ger. *Eisenwein*.)

**Manufacture:** Dissolve iron and ammonium citrate 4 Gm. in white wine 70 Cc., add tincture of sweet orange-peel 6, syrup 10, white wine q. s. 100 Cc., filter after several days. Dose,  $\mathfrak{zj}$ –4 (4–15 Cc.).

**PROPERTIES AND USES.**—Tonic; chlorosis, anæmia, etc.

**Ferri et Ammonii Tartras. Iron and Ammonium Tartrate.**—(Syn., Ammonio-ferric Tartrate, *Ferrum Tartaricum Ammoniatum*, *Ferri Ammonio-tartras*, Ammonio-tartrate of Iron; Fr. *Tartrate ferrique ammoniacal*, *Tartrate de Fer et d'Ammoniaque*; Ger. *Weinsaures Eisenoxyd-Ammonium*, *Ferriammontartrat*.)

**Manufacture:** Add solution of ferric sulphate 100 Cc., diluted with 1,300 Cc. water, to ammonia water 110 Cc., previously diluted with 250 Cc. water, wash precipitate; dissolve tartaric acid 14.5 Gm. in 200 Cc. distilled water, neutralize with ammonia water, add tartaric acid 14.5 Gm., heat until dissolved, then add precipitate (ferric hydroxide) in portions, when dissolved filter, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red or reddish-brown scales, odorless, sweetish, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 13 p. c. of metallic iron. **Tests:** 1. Chars into ferric oxide with burnt-sugar odor, giving a product which should not be alkaline (abs. of citrates, tartrates of the alkali metals). 2. It is not precipitated, but simply darkened by ammonia water. 3. Heated with potassium hydroxide T. S. get a reddish precipitate and ammonia vapors. **Assay:** Same as for ferric citrate, except that 13 Cc. of V. S. are required to discharge color (each Cc. of V. S.



indicating 1 p. c. of metallic iron). Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

PROPERTIES AND USES.—Mild chalybeate; anæmia, etc.

**Ferri et Potassii Tartras.** Iron and Potassium Tartrate.—(Syn., Potassio-ferric Tartrate, Ferri Potassio-tartras, Ferrum Tartarizatum, Tartras (Ferrico-potassicus) Ferrico-kalicus, Ferro-tartrate of Potassium; Tartarated (Tartarized) Iron; Br. Ferrum Tartaratum; Fr. Tartrate de Fer et de Potasse, Tart(a)re chalybé, Tartre martial; Ger. Weinsaures Eisenoxyd-Kali, Eisenweinstein, Tartarus ferratus.)

*Manufacture:* Solution of ferric sulphate 100 Cc., potassium bitartrate 38 Gm., distilled water 300 Cc., ammonia water 110 Cc., also q. s. to dissolve the precipitate, water q. s.; prepare ferric hydroxide as in ferri et ammonii tartras, heat potassium bitartrate with distilled water, gradually adding the precipitate (ferric hydroxide) in portions, stirring, when dissolved filter, let stand 24 hours, stir so as to incorporate precipitate, add ammonia water to dissolve same, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red to reddish-brown scales, odorless, sweetish, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 15 p. c. of metallic iron. *Tests:* 1. Chars into ferric oxide with burnt-sugar odor; this residue is alkaline, and effervesces with acids (dis. from iron and ammonium tartrates). 2. It is not precipitated, but simply darkened by ammonia water. 3. With potassium hydroxide T. S. get a reddish precipitate and ammonia vapors. *Assay:* Same as in ferric citrate, except that 15 Cc. of V. S. are required to discharge color (each Cc. of V. S. indicating 1 p. c. of metallic iron). Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), ter die.

PROPERTIES AND USES.—One of the richest in iron, most agreeably tasting, least constipating and least irritating to stomach and bowels, of the iron salts.

**Ferri Hydroxidum.** Ferric Hydroxide,  $\text{Fe}(\text{OH})_3$ .—(Syn., Ferri Oxidum Hydratum, U. S. P. 1890, Ferric Hydrate (Oxyhydrate), Hydrated Oxide of Iron, Ferri Sesquioxidum (Oxidum Rubrum), Hydrated (Peroxide) Sesquioxide of Iron, Hydras Ferricus, Ferrugo; Br. Ferri Peroxidum Hydratum; Fr. Sesquioxide (Peroxide) de Fer hydraté humide, Hydrate de Peroxyde de Fer gélatineux; Ger. Feuchtes Eisenoxydhydrat, Gegengift der Arsenigensäure.)

*Manufacture:* To ammonia water 138 Cc., diluted with 500 Cc. water, add, with constant stirring, solution of ferric sulphate 100 Cc., previously diluted with 1,000 Cc. water, wash precipitate several times with 1,000 Cc. water, finally mix it with water q. s. 300 Gm.; if order reversed, have basic ferric sulphate formed. When this is wanted for use in arsenous acid poisoning, and need is urgent, much washing can be dispensed with, as the retained ammonia serves as a stimulant, and thus may neutralize some of the depressant effects of the poison. It is a brownish-red magma, soluble in hydrochloric acid without effervescence. Dose,  $\frac{3}{4}$ –4 (4–15 Gm.).

PREPARATIONS.—(Unoff.) *Plaster. Troches*,  $4\frac{1}{2}$  gr. (.28 Gm.).

PROPERTIES AND USES.—Solely as antidote to arsenic-poisoning, possibly inferior to saccharated oxide; although it acts by combination, yet it is believed largely to envelop the poison mechanically, thereby keeping it from being absorbed, hence should empty stomach shortly after giving it; should always freshly prepare this, as it becomes inefficient by age.

**Ferri Hydroxidum cum Magnesii Oxido.** **Ferric Hydroxide with Magnesium Oxide.**—(Syn., *Ferri Oxidum Hydratum cum Magnesia*, U. S. P. 1890, *Arsenic Antidote*, *Hydrated Oxide of Iron with Magnesia*, *Antidotum Arsenici*; Fr. *Contrepoison de l'Arseenic*; Ger. *Genggift (des Arseniks) der Arsenigsäure*.)

*Manufacture*: Mix solution of ferric sulphate 40 Cc. with 125 Cc. water, keep liquid in large, well-stoppered bottle; rub magnesium oxide 10 Gm. with water to smooth thin mixture, transfer to bottle holding 1,000 Cc., and fill it three-fourths with water. When wanted for use shake latter mixture to thin homogeneous magma and add it gradually to the former (iron) solution, shake until smooth. A more valuable preparation than the preceding.

USES.—As an antidote to arsenic in large doses (3iv–6; 120–180 Cc.), made up freshly.

**Ferri Carbonas Saccharatus.** **Saccharated Ferrous Carbonate,**  $\text{FeCO}_3$ .—(Syn., *Carbonas Ferrosus Saccharatus*; Fr. *Saccharure (de Carbonate ferreux) de Proto-carbonate de Fer*; Ger. *Ferrum carbonicum saccharatum*, *Zuckerhaltiges (Kohlensaures Eisen) Ferrocarbonat*.)

*Manufacture*: Dissolve ferrous sulphate 50 Gm. in hot distilled water 200 Cc.; also sodium bicarbonate 35 Gm., in distilled water 500 Cc., filter both solutions and add former to latter in a large flask, wash the precipitate thoroughly by filling flask with hot distilled water several times, siphoning off clear supernatant liquid each time, strain, mix with sugar 80 Gm., evaporate to dryness, reduce to powder, add sugar q. s. 100 Gm.— $(\text{FeSO}_4 + 10\text{H}_2\text{O}) + 2\text{NaHCO}_3 = \text{FeCO}_3 + \text{Na}_2\text{SO}_4 + \text{CO}_2 + 11\text{H}_2\text{O}$ ; contains 15 p. c. of ferrous carbonate. It is a greenish-brown powder, oxidizing by age, odorless, taste sweetish, then ferruginous; partially soluble in water, entirely so in HCl. *Assay*: Dissolve 1.15 Gm. in 10 Cc. diluted  $\text{H}_2\text{SO}_4$  + water q. s. 100 Cc., requires 15 Cc.  $\frac{\text{N}}{10}$  potassium permanganate V. S. to give permanent pink tint (each Cc. of V. S. indicating 1 p. c. of pure ferrous carbonate). *Impurities*: Sulphate, etc. Should be kept in small, well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), in pill.

PROPERTIES AND USES.—Takes the place of subcarbonate and the anciently used iron-rust in anæmia, chlorosis, neuralgia, chorea.

*Allied Salt*:

1. *Ferri Subcarbonas.* *Subcarbonate of Iron*,  $\text{Fe}_2\text{O}_3 \cdot \text{Fe}_2(\text{OH})_6$ .—Official 1840–1880. Made by mixing iron sulphate 225 Gm., dissolved in water 2,000 Cc., with sodium carbonate 250 Gm., dissolved in water 2,000 Cc., wash and dry the precipitate without heat. It is a reddish-brown powder, soluble in diluted HCl with slight efferves-

cence; when dried by heat dissolves with difficulty in diluted HCl, as it then consists chiefly of the oxyhydrate,  $\text{Fe}_2\text{O}_3(\text{OH})_2$ . On exposure takes up oxygen, thus losing its original character and becoming a more insoluble oxide. Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Chalybeate tonic; anæmia, anæmic chlorosis, chorea, neuralgia, ulcers, in emergency for arsenous acid poisoning—acts here mechanically and by combination; now replaced by *ferri carbonas saccharatus*.

**Massa Ferri Carbonatis.** Mass of Ferrous Carbonate.—(Syn., Vallet's Mass, Pill of Carbonate of Iron, Vallet's Ferruginous Pills, *Pilulæ Ferratæ Valleti*; Br. *Pilula Ferri Carbonatis*; Fr. *Masse pilulaire de Vallet—de Carbonate ferreux*, *Pilules de Carbonate ferreux—ferrugineuses*; Ger. *Valletsche Pillenmasse*, *Pilulæ Ferri carbonici*.)

**Manufacture:** Dissolve ferrous sulphate, crystals, 100 Gm. in hot distilled water 200 Cc.; also monohydrated sodium carbonate 46 Gm. in boiling distilled water 200 Cc., to iron solution add syrup 20 Cc., filter both solutions, let cool, add gradually the iron solution to the sodium, constantly rotating bottle; when carbonic acid gas has escaped, fill bottle with water, cork, let stand, wash precipitate with mixture of syrup (1) and distilled water (19), drain, express, mix precipitate with clarified honey 38 Gm. and sugar 25 Gm., evaporate, with constant stirring, to 100 Gm.— $(\text{FeSO}_4 + 7\text{H}_2\text{O}) + (\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}) = \text{FeCO}_3 + \text{Na}_2\text{SO}_4 + 17\text{H}_2\text{O}$ ; contains 36 p. c. of ferrous carbonate. It is unchangeable, non-astringent, soluble in acids. Dose, gr. 1–5 (.06–.3 Gm.), in pill, after meals.

**PROPERTIES AND USES.**—Tonic; anæmia, chlorosis, etc.

**Mistura Ferri Composita.** Compound Iron Mixture.—(Syn., Griffith's Mixture, Fr. *Mixture de Griffith*; Ger. *Griffithsche Eisenmixture*.)

**Manufacture:** Rub until uniform myrrh 1.8 Gm., sugar 1.8, potassium carbonate .8, with rose water 70 Cc., add spirit of lavender 6, then ferrous sulphate, crystals, 6 Gm. previously dissolved in rose water 5 Cc., finally rose water q. s. 100 Cc. It is a dark green mixture, containing ferrous carbonate resulting from double decomposition of the salts used. It should be made freshly when wanted. Dose, 3j–2 (30–60 Cc.), *ter die*.

**PROPERTIES AND USES.**—Good tonic in debility of digestive organs; chlorosis, hysteria, phthisis, chronic catarrh.

**Pilulæ Ferri Carbonatis.** Pills of Ferrous Carbonate.—(Syn., Ferruginous Pills, Chalybeate Pills, Bland's Pills; Br. *Pilula Ferri*, Iron Pill, Pills of Iron; Fr. *Pilules (chalybes) ferrugineuses de Bland (Griffith)*; Ger. *Blandsche (Griffithsche) Pillen*.)

**Manufacture:** Rub potassium carbonate 8 Gm. with glycerin and water each 10 drops, add granulated ferrous sulphate 16 Gm. and sugar 4, previously triturated together, rub mass until greenish; when reaction over, add tragacanth 1 Gm., althæa 1, make into mass with water, divide into 100 pills. These pills contain each about 1 gr.

(.06 Gm.) ferrous carbonate in a fresh state, resulting from double decomposition of the two salts. Should be freshly prepared when wanted. Dose, 1–2 pills.

PROPERTIES AND USES.—Tonic in debility of digestive organs; chlorosis, hysteria, phthisis, chronic catarrh.

**Ferri Hypophosphis.** **Ferric Hypophosphite**,  $\text{Fe}(\text{PH}_2\text{O}_2)_3$ .—(Syn., *Ferrum Hypophosphorosum*, *Hypophosphis Ferricus*, *Hypophosphite of Iron*; Fr. *Hypophosphite de Fer*; Ger. *Unterphosphorig-saures Eisenoxyd*, *Ferrihypophosphit*.)

*Manufacture*: Sodium (or calcium) hypophosphite solution is added to ferric chloride (or sulphate) solution, precipitate washed, dried with moderate heat— $6\text{NaPH}_2\text{O}_2 + \text{Fe}_2\text{Cl}_6 = 2\text{Fe}(\text{PH}_2\text{O}_2)_3 + 6\text{NaCl}$ ; may also be made from iron sulphate and calcium hypophosphite; when the solution contains ferrous hypophosphite, which on evaporation becomes ferric. It is a white or grayish-white powder, odorless, nearly tasteless, permanent, soluble in 2,300 parts water, when heated get inflammable hydrogen phosphide gas and ferric pyrophosphate, oxidized by nitric acid; contains 98 p. c. of pure salt. *Impurities*: Heavy metals, calcium, carbonate, phosphate. Should be kept in well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.), in pill, powder, syrup.

PREPARATION.—1. *Syrupus Hypophosphitum Compositus*,  $\frac{1}{2}$  p. c.

PROPERTIES AND USES.—In anæmia, defective nerve-nutrition.

*Allied Salts*:

1. *Ferri Valeras* (*Valerianas*). **Ferric Valerate** (*Valerianate*),  $\text{Fe}_2(\text{C}_5\text{H}_9\text{O}_2)_6$ .—Obtained by precipitating diluted solution ferric sulphate (or chloride) with cold solution sodium valerate (valerianate), washing, drying precipitate. It is a dark brick-red amorphous powder, varying composition, valerian odor, permanent, insoluble in cold water, soluble in alcohol; chars into ferric oxide, contains 15–20 p. c. of metallic iron. Chalybeate tonic; anæmia, nervous exhaustion, hysteria, diabetes insipidus. Dose, gr. 1–5 (.06–.3 Gm.).

2. *Ferri Arsenas*. **Iron Arsenate**,  $3\text{Fe}(\text{FeO})\text{AsO}_4 \cdot 16\text{H}_2\text{O}$ .—Obtained by dissolving separately in water sodium arsenate and ferrous sulphate, mixing, neutralizing solution with sodium bicarbonate, wash, dry precipitate. A greenish amorphous powder, insoluble in water; contains 31.68 p. c.  $\text{As}_2\text{O}_3$  + 26.4 p. c. water. Dose, gr.  $\frac{1}{10}$ – $\frac{1}{2}$  (.006–.03 Gm.).

3. *Ferri Bromidum*. **Ferrous Bromide**,  $\text{FeBr}_2 \cdot 6\text{H}_2\text{O}$ .—Obtained by digesting bromine 2 parts, iron wire or filings 1, water 10, until liquid becomes greenish, filter, evaporate. It is a yellowish, styptic, deliquescent, soluble salt, very poisonous, should be employed cautiously. Dose, gr. 1–3 (.06–.2 Gm.); syrup, ℞xv–30 (1–2 Cc.).

4. *Ferri Ferrocyanidum*. **Ferric Ferrocyanide**,  $\text{Fe}_3\text{Fe}(\text{CN})_6$ .—Obtained by adding an aqueous solution potassium ferrocyanide to diluted solution ferric sulphate. It is dark blue, insoluble in water; poor chalybeate—its iron inert, cyanogen non-poisonous. Dose, ʒss–1 (2–4 Gm.).

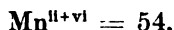
5. *Ferri Sulphidum*. **Ferrous Sulphide**,  $\text{FeS}$ .—Obtained by melting together small pieces of iron and sublimed sulphur; used only for generating hydrogen sulphide.

*Condensed Table giving Basal Iron Preparations and Products therefrom; each single one, or set included within bracket, to right of its equation mark being manufactured from that individual product preceding it.*

Ferrum =	I. Liq. Fe Chlor. =	$\left\{ \begin{array}{l} 1. \text{ Ferri Chloridum.} \\ 2. \text{ Tr. Fe Chlor.} = \text{Liq. Fe et Am. Acetatis (Basham's Mixture), 2 p. c.} \\ 3. \text{ Fe Hypophosphis (Pp. with Na Hypophosphite).} \end{array} \right.$
	II. Syr. Fe Iod. = Fe Iod. Saccharatum (20 p. c. FeI <sub>2</sub> ) = Pil. Fe Iod. (Blancard's).	
	III. Fe Lactate = Syr. Hypophosphitum cum Ferro, 1 p. c.	$\left\{ \begin{array}{l} 1. \text{ Fe Cit.} = \\ 2. \text{ Fe et Am. Cit.} = \\ 1. \text{ Reductum.} \\ 2. \text{ Emplastrum.} \\ 3. \text{ Trochisci.} \end{array} \right.$
	IV. Fe Sulph. =	$\left\{ \begin{array}{l} 1. \text{ Fe Sulph. Exsic.} = \text{Pil. Aloes et Ferri.} \\ 2. \text{ Fe Sulph. Gran.} \\ 3. \text{ Fe Oxalas.} \\ 4. \text{ Liq. Fe Subsulph.} \\ 5. \text{ Liq. Fe Tersulphatis.} = \\ 6. \text{ Fe Carb. Sacch.} \\ 7. \text{ Fe Subcarb.} \\ 8. \text{ Massa Fe Carb.} \\ 9. \text{ Mist. Fe Carb.} \\ 10. \text{ Pil. Fe Carb.} \\ 11. \text{ Fe Hypophosphia.} \\ 12. \text{ Fe Arenas.} \end{array} \right.$
	V. Fe Brom.	
	VI. Syr. Fe Brom. (10 p. c. FeBr <sub>3</sub> ).	
	VII. Fe Sulphidum.	

- $\left\{ \begin{array}{l} 1. \text{ Fe et Quin. Cit.} \\ 2. \text{ Fe et Quin. Cit. Sol.} = \text{Vin. Fe Amara.} \\ 3. \text{ Fe Phos. Sol.} = \text{Elix., Glyc. and Syr. Fe, Quin. et S, Phos.} \\ 4. \text{ Fe Pyrophos. Sol.} \\ 1. \text{ Fe et Strych. Cit.} \\ 2. \text{ Vin Ferri.} \end{array} \right.$

## MANGANUM. MANGANESE.



The element manganese (L. corrupt. of *magnes*, from resemblance to the magnet, or from magnesia transposed, as both were confounded until 1740) is not of great importance in medicine; it occurs natively in considerable quantities as black oxide,  $\text{MnO}_2$  (pyrolusite, hausmannite, braunite), as sesquioxide,  $\text{Mn}_2\text{O}_3$ , as carbonate,  $\text{MnCO}_3$ ; from this latter the metal may be obtained by heating with charcoal— $\text{MnCO}_3 + 2\text{C} = \text{Mn} + 3\text{CO}$ . It resembles iron very closely, but oxidizes easier, is harder and more brittle; sp. gr. 7.20; gives only three official salts.

*Tests for Manganese Salts:* 1. With ammonium sulphide get flesh-colored precipitate. 2.  $\text{Na}_2\text{CO}_3$  or  $\text{K}_2\text{CO}_3$  gives white precipitate insoluble in excess of ammonium carbonate. 3. Borax bead is violet or amethyst. 4. Heated with  $\text{Na}_2\text{CO}_3 + \text{NaNO}_3$  get bluish-green mass, forming with water a green solution which turns red with an acid.

**Mangani Dioxidum Præcipitatum. Precipitated Manganese Dioxide.**—(Syn., Mangani Dioxidum, U. S. P. 1890; Fr. Bioxyde (Peroxyde) de Manganèse précipité; Ger. Präcipitistes Mangandioxyd.)

*Manufacture:* Dissolve manganese sulphate 50 Gm. in 1,000 Cc. distilled water; add to ammonia water 250 Cc. an equal volume distilled water, mix this with solution of hydrogen dioxide 250 Cc., previously diluted with equal volume distilled water, pour this slowly into solution of manganese sulphate, let stand an hour, frequently stirring, wash precipitate with hot distilled water, drain, dry. It is a heavy, very fine, black powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in hot sulphuric and hydrochloric acids, forming sulphate and chloride respectively, at red heat gives off oxygen, being converted into reddish-brown manganoso-manganic oxide,  $\text{Mn}_3\text{O}_4$ ; consists chiefly of  $\text{MnO}_2$ , 80 p. c., with small amounts of other oxides of manganese. *Assay:* 0.2 Gm. dissolved in 50 Cc.  $\frac{\text{N}}{10}$  oxalic acid V. S. + 3 Cc. sulphuric acid, with heat, the resulting solution diluted with warm water 100 Cc. should require 13 Cc.  $\frac{\text{N}}{10}$  potassium permanganate V. S. to produce slight pink tint (corresponding to 80 p. c. of pure salt). *Impurities:* Antimony sulphide, insoluble substances. Dose, gr. 3–10 (.2–.6 Gm.).

**PROPERTIES AND USES.**—Tonic, alterative, after prolonged usage may act as cumulative poison, causing staggering, paraplegia; good in syphilis, chlorosis, scurvy, skin diseases, itch, porrigo, stomach pains, pyrosis, gastralgia, simple ulcers. Acts solely as a coating to stomach, like bismuth salts.

*Allied Salt:*

1. *Mangani Dioxidum. Manganese Dioxide,  $\text{MnO}_2$ .* Official 1860–1900. This is the native crude manganese dioxide, containing 66 p. c. of pure dioxide,  $\text{MnO}_2$ ; it is a heavy, grayish-black, gritty powder,

odorless, tasteless, permanent, insoluble in water, alcohol; soluble in sulphuric or hydrochloric acid. It is important: 1, for liberating chlorine from HCl or NaCl in making bleaching-powder, mercuric chloride, etc.; 2, for oxygen in laboratory work; 3, for furnishing manganese salts; 4, for black glazing to pottery; 5, for freeing glass from iron coloration; 6, for mixing with iron to furnish the best steel; 7, in veterinary practice.

**Mangani Sulphas.** **Manganese Sulphate**,  $\text{MnSO}_4 + 4\text{H}_2\text{O}$ .—(Syn., Manganous Sulphate, Manganesii Sulphas, Manganum Sulphuricum, Sulfas Manganosus; Fr. Sulfate (de Manganèse) manganoux; Ger. Schwefelsaures Manganoxydul, Manganosulfat.)

*Manufacture*: Mix manganese dioxide with sufficient sulphuric acid for thin magma, boil, evaporate to dryness, heat mass to dull redness to decompose iron sulphate, cool, treat with water, evaporate filtrate to crystallization. It is in colorless, or pale rose-colored, translucent, tetragonal prisms, odorless, slightly bitter, astringent taste, efflorescent, soluble in 0.7 part water, insoluble in alcohol; contains 99.5 p. c. of pure salt. *Test*: 1. 1 Gm. gently ignited should lose not more than 0.323 Gm. in weight (dis. from manganese sulphate containing a larger amount of water of crystallization). *Impurities*: Heavy metals, iron, zinc, magnesium, salts of alkalies. Should be kept in well-stoppered bottles. Dose, tonic, gr. 3–10 (.2–.6 Gm.), in pill or solution.

**PROPERTIES AND USES.**—Tonic, cholagogue cathartic, styptic, large doses sedative to nerves and circulation, poisonous. Once considered a good substitute for iron, but now believed to have very little effect on chlorosis, anæmia, or impoverished systems. An ointment acts as an irritant to enlarged glands, swollen joints, etc.

*Incompatibles*: Salts of lead, silver, mercury.

*Synergists*: Iron, zinc, copper.

**Mangani Hypophosphis.** **Manganese Hypophosphite**,  $\text{Mn}(\text{PH}_2\text{O}_2)_2 + \text{H}_2\text{O}$ .—(Syn., Manganum Hypophosphorosum; Fr. Hypophosphite de Manganese (Manganoux); Ger. Unterphosphorigsaures Manganoxydul.)

*Manufacture*: Mix solution of 1 part calcium hypophosphite with solution 1.31 parts manganese sulphate, stir, set in warm place for calcium sulphate to subside, filter, evaporate solution, or allow to crystallize. It is a pink crystalline powder, odorless, nearly tasteless, permanent, soluble in 6.6 parts water, nearly insoluble in alcohol; contains 97 p. c. of pure salt. *Impurities*: Arsenic, calcium, carbonate, phosphate. Should be kept in well-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

**PREPARATION.**—1. *Syrupus Hypophosphitum Compositus*,  $\frac{1}{2}$  p. c.

**PROPERTIES AND USES.**—Same as for calcium hypophosphite.

## CHROMIUM.

$$\text{Cr}^{\text{II} + \text{VI}} = 51.7.$$

The element chromium (Gr. *χρῶμα*, color, + *ium*—i. e., salts are colored) is not of much service in medicine, as it enters into only one official compound. Natively it mostly occurs as chrome iron ore or chromite,  $\text{FeO}, \text{Cr}_2\text{O}_3$ , having analogous composition to magnetic iron ore,  $\text{FeO}, \text{Fe}_2\text{O}_3$ ; it forms two basic oxides, *chromous*,  $\text{CrO}$ , and *chromic*,  $\text{Cr}_2\text{O}_3$ , and an acid oxide, trioxide,  $\text{CrO}_3$  (official), also have dioxide,  $\text{CrO}_2$ , and trichromic tetroxide,  $\text{Cr}_3\text{O}_4$ .

*Tests for Chromium Salts*: 1.  $\text{NaOH}$ ,  $\text{KOH}$ ,  $\text{NH}_4\text{OH}$ , and  $\text{NH}_4\text{SH}$  will each precipitate green chromic hydroxide,  $\text{Cr}_2(\text{OH})_6$ . 2. Soluble lead salts precipitate lead chromate (chrome yellow),  $\text{PbCrO}_4$ , insoluble in acetic acid, soluble in  $\text{HCl}$  and  $\text{NaOH}$ .

**Chromii Trioxidum.** Chromium Trioxide,  $\text{CrO}_3$ .—(Syn., Acidum Chromicum, U. S. P. 1890, Chromic Trioxide (Anhydride), Anhydrous Chromic Acid; Fr. Acide chromique; Ger. Acidum chromicum, Chromsäure.)

*Manufacture*: Heat together potassium dichromate 30 parts, water 50, sulphuric acid 77.5, let stand 12 hours; to filtrate add in small portions sulphuric acid 27.5, continually stirring, let stand 12 hours, drain crystals— $\text{K}_2\text{Cr}_2\text{O}_7 + 2\text{H}_2\text{SO}_4 = 2\text{CrO}_3 + 2\text{KHSO}_4 + \text{H}_2\text{O}$ . It is in small, needle-shaped crystals or rhombic prisms, dark purplish-red color, metallic lustre, odorless, destructive to animal and vegetable tissues, deliquescent, soluble in water (orange-red solution), forming chromic acid,  $\text{H}_2\text{CrO}_4$ , in contact with alcohol, ether, glycerin, and other organic solvents decomposition results, sometimes with dangerous violence from liberation of oxygen; contains 90 p. c. of pure salt. *Assay*: Dissolve 1 Gm. in water 100 Cc., of this 8.3 Cc. + 2 Cc. hydrochloric acid, + 1 Gm. potassium iodide, well shaken, should require, after diluting with 100 Cc. water, + 5 Cc. starch T. S., 22.5 Cc.  $\frac{\text{N}}{10}$  sodium thiosulphate V. S. to change deep blue color to light green (each Cc. of V. S. indicating 4 p. c. of pure salt). *Impurities*: Sulphuric acid, etc., should be kept in glass-stoppered bottles, and handled out of contact with organic substances, such as cork, tannic acid, sugar, alcohol, collodion, etc., as serious accidents might result. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.008–.016 Gm.).

*PREPARATION*.—(Unoff.) *Liquor Acidi Chromici* (Br.), 25 p. c.

**PROPERTIES AND USES**.—Antiseptic, disinfectant, deodorant, escharotic, astringent; coagulates albumin. Used externally on growths in the mouth, larynx, pharynx, nasal passages (polypi), rhinitis, gangrene, scorbutic, syphilitic, or gangrenous ulcers, tumors, bites of rabid animals, poisoned wounds, tinea, sycosis, lupus, sweating or tender feet, conjunctivitis, uterine hemorrhage, leucorrhœa, gonorrhœa, incontinence of urine. The aqueous solution is used mostly, 5–10 p. c., or even varying up to the strong acid.



*Poisoning:* Similar to potassium dichromate. Give emetics, then magnesium oxide or carbonate, sodium bicarbonate or borate, demulcent drinks (milk, egg-white), stimulants, heat, opium, stimulant enemas.

### ZINCUM. ZINC.

$$\text{Zn}^{\text{II}} = 64.9.$$

(Syn., Speltrum; Fr. Speltre, Zinc; Ger. Zink.)

The metal zinc (Ger. *zinn*, tin, with which it formerly was confounded) is official as thin sheets, irregular, granulated pieces, moulded into thin pencils, or as fine powder. Occurs natively as sulphide (zinc-blend),  $\text{ZnS}$ , as carbonate (calamine),  $\text{ZnCO}_3$ , as silicate, and as red oxide, and is obtained pure by subliming carbonate or oxide mixed with charcoal; the vaporized metal distils into receivers, where it solidifies. It is bluish-white, crystalline fracture, tarnishes slowly with a film of oxide or carbonate, malleable, sp. gr. 6.9 when cast, 7.2 when rolled, soluble in diluted sulphuric or hydrochloric acid with evolution of hydrogen, melts at  $940^\circ \text{C}$ . ( $1724^\circ \text{F}$ .); contains 99 p. c. of pure metal. *Impurities:* Lead, copper, cadmium, arsenic, antimony, sulphur, phosphorus. It is a component of German silver and of brass, and is the coating material of galvanized iron. *Impurities:* Lead, copper, arsenic, cadmium, antimony, sulphur, phosphorus.

*Tests for Zinc Salts:* 1.  $\text{NH}_4\text{SH}$  precipitates white zinc sulphide,  $\text{ZnS}$ , which is the only white insoluble sulphide. 2.  $\text{NaOH}$ ,  $\text{KOH}$ , or  $\text{NH}_4\text{OH}$  precipitates white zinc hydroxide,  $\text{Zn}(\text{OH})_2$ , soluble in excess. 3.  $\text{K}$  and  $\text{Na}$  carbonates and phosphates give white precipitates insoluble in excess. This is the only heavy metal having all compounds colorless; its salts are incompatible with vegetable astringents, alkalies, carbonates, lime water, sulphides, silver nitrate, lead acetate, milk; the soluble salts (sulphate, chloride) are poisonous, and should they not cause vomiting give plenty warm water containing alkaline carbonates, or mustard, then egg-white and milk, tannin or some vegetable astringent, opium, heat to abdomen.

**Zinci Bromidum. Zinc Bromide,  $\text{ZnBr}_2$ .**—(Syn., Zincum Bromatum, Bromuretum Zincicum; Fr. Bromure de Zinc; Ger. Zinkbromid, Bromzink.)

*Manufacture:* Digest granulated zinc in hydrobromic acid, evaporate, dry— $\text{Zn} + 2\text{HBr} = \text{ZnBr}_2 + \text{H}_2$ ; or digest zinc, bromine, and water together, evaporate. It is a white granular powder, odorless, taste sharp, saline, metallic, very deliquescent, soluble in water, alcohol; contains, when anhydrous, 97 p. c. of pure salt. *Assay:* Dissolve 0.3 Gm. in 10 Cc. water + 2 drops potassium chromate T. S.; this should require 26–26.8 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to produce permanent red color (corresponding to 97 p. c. of pure salt). *Impurities:* Lead, copper, cadmium, arsenic, chloride, iodide, sulphate. Should be kept in small, glass-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

**PROPERTIES AND USES.**—Antispasmodic, hypnotic, nervine, tonic, irritant poison; epilepsy.

**Zinci Chloridum.** Zinc Chloride,  $\text{ZnCl}_2$ .—(Syn., Butter of Zinc; Fr. Chlorurétum Zincicum, Chlorure de Zinc; Ger. Zinkum chloratum, Zinkchlorid, Chlorzink.)

**Manufacture:** Dissolve zinc in HCl by boiling— $2\text{Zn} + 4\text{HCl} = 2\text{ZnCl}_2 + \text{H}_2$ ; the solution also contains iron and lead chlorides, which are removed by adding  $\text{HNO}_3$  to form ferric chloride, and then zinc carbonate to precipitate ferric hydroxide, filter, evaporate. It is in white, granular powder, or porcelain-like masses, irregular, or moulded pencils; odorless, astringent, metallic taste, very deliquescent, soluble in alcohol, .4 part water; contains, when anhydrous, 99.5 p. c. of pure salt. **Assay:** Dissolve 0.5 Gm. in boiling distilled water 200 Cc., add 5 drops phenolphthalein T. S., + sufficient sodium carbonate T. S. for red color, wash precipitate with boiling distilled water, dissolve in nitric acid, evaporate to dryness, ignite, residue should weigh 0.297 Gm. **Impurities:** Lead, copper, cadmium, arsenic, oxychloride, sulphate. Should be kept in small glass-stoppered bottles. Dose, gr.  $\frac{1}{10}$ — $\frac{1}{2}$  (.006–.03 Gm.).

**PREPARATIONS.**—1. *Liquor Zinci Chloridi.* Solution of Zinc Chloride. (Syn., Burnett's Disinfecting Fluid; Fr. Chlorure de Zinc liquide, Soluté de Burnett; Ger. Flüssiges Chlorzink, Chlorzinklösung.) An aqueous solution of zinc chloride,  $\text{ZnCl}_2$ , containing 50 p. c., by weight, of the salt.

**Manufacture:** To zinc, granulated, 24 Gm., add distilled water 15 Cc., to this gradually add hydrochloric acid 84 Gm., digest until reaction ceases, pour off solution, add nitric acid 1.2 Gm., heat until a portion, removed and cooled, solidifies, cool, dissolve solidified mass in distilled water q. s. 100 Gm., then add precipitated zinc carbonate 1.2 Gm., agitate occasionally 24 hours, set aside until clear, separate clear solution by decantation or siphon; the nitric acid oxidizes iron into ferric chloride, while the zinc carbonate precipitates this as ferric oxide. It is a clear, colorless, aqueous liquid, odorless, very astringent, metallic taste, acid reaction, sp. gr. 1.548; contains 50 p. c., by weight, of pure salt. Dose,  $\text{M}\frac{1}{2}$ –1 (.016–.06 Cc.); seldom used internally.

**PROPERTIES AND USES.**—Alterative, antispasmodic, astringent, escharotic, caustic, antiseptic, disinfectant. Internally—in scrofula, epilepsy, chorea, nervous troubles. Externally—in cancerous affections, tumors, cancers, aneurism, malignant and morbid growths, lupus, ulcers of uterus, etc., leucorrhœa, gonorrhœa, hemorrhagic endometritis, cystic tumors, nasal polypi, abscesses, scrofulous glands; to fill carious teeth, vascular and thickened conjunctiva. The liquor is the weaker form, used chiefly to deodorize and disinfect sewers, sinks, water-closets, hospitals, dissecting-rooms, etc., for embalming, to preserve anatomical subjects. When diluted (1 in 18) used as injection in gonorrhœa, leucorrhœa, etc., and as wash for ulcers, abscesses, to destroy putrid odor, etc. The salt itself sometimes applied for caustic pur-

poses in pasty form, diluted 2–3–4–5 times with wheat flour, rye flour, or gluten.

*Poisoning*: Symptoms similar to violent corrosive irritant poison; corrosion of lips and mouth, burning in throat, stomach, bowels, vomiting (blood-stained), increased pulse and respiration, dyspnoea, paralysis, cold surface, dilated pupils, coma, convulsions, death. Give alkalis, alkali carbonates, emetics, soap, milk, albumin, anodynes, opium, flax-seed poultices to abdomen, stimulants, tannin.

**Zinci Iodidum.** Zinc Iodide,  $\text{ZnI}_2$ .—(Syn., Ioduretum Zincicum; Fr. Iodure de Zinc; Ger. Zinkjodid, Jodzink.)

*Manufacture*: Dissolve zinc oxide, carbonate, or metal, in hydriodic acid, or digest metal with iodine and water, evaporate to dryness—(1)  $\text{Zn} + 2\text{HI} = \text{ZnI}_2 + \text{H}_2$ . (2)  $\text{Zn} + \text{I}_2 + \text{H}_2\text{O} = \text{ZnI}_2 + \text{H}_2\text{O}$ . It is a white granular powder, odorless, sharp, saline, metallic taste, very deliquescent, on exposure turning brown from liberated iodine, soluble in water, alcohol, ether, heated leaves residue of zinc oxide; contains, when anhydrous, 98 p. c. of pure salt. *Assay*: Dissolve 0.5 Gm. in water 20 Cc., add 35 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. + 5 Cc. nitric acid + 3 Cc. ferric ammonium sulphate T. S., shake, should require 3.4–4 Cc.  $\frac{\text{N}}{10}$  potassium sulphocyanate V. S. for permanent reddish-brown tint. *Impurities*: Lead, copper, cadmium, arsenic, chloride, sulphate. Should be kept dark, in small, glass-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.), in solution or syrup.

**PROPERTIES AND USES.**—Alterative, astringent, caustic; chorea, scrofula, hysteria. Externally—similar to chloride in enlarged tonsils, tumors, gonorrhœa, leucorrhœa; applied as ointment 10 p. c., or solution 2–5 p. c., or injection  $\frac{1}{5}$ – $\frac{1}{2}$  p. c.

*Allied Salt*:

1. **Zinci Phosphidum.** Zinc Phosphide,  $\text{Zn}_3\text{P}_2$ .—Obtained by fusing zinc and phosphorus, or pass phosphorus vapors in a current of dry hydrogen over fused zinc— $3\text{Zn} + 2\text{P} + \text{heat} = \text{Zn}_3\text{P}_2$ . It contains 25 p. c. of phosphorus, and is a gritty, dark gray powder, or in crystalline fragments of dark metallic lustre, faint odor, phosphorus taste, insoluble in water, alcohol, soluble in diluted acids. Nervous stimulant, aphrodisiac, similar to phosphorus; defective nutrition of brain and spine, locomotor ataxia, paralysis, chlorosis, anæmia, amenorrhœa, etc. Should be kept in small, glass-stoppered vials. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{4}$  (.004–.02 Gm.), in pill, powder, syrup, on empty stomach.

**Zinci Sulphas.** Zinc Sulphate,  $\text{ZnSO}_4 + 7\text{H}_2\text{O}$ .—(Syn., Vitriolum Album, White Vitriol; Fr. Sulfas Zincicus, Sulfate de Zinc, Vitriol blanc, Couperose blanche; Ger. Zincum sulfuricum, Zinksulfat, Schwefelsaures Zinkoxyd, Weisser Vitriol, Galitzenstein.) This is the most important zinc salt.

*Manufacture*: Dissolve zinc in diluted sulphuric acid, remove iron and lead chlorides with  $\text{HNO}_3$  and zinc carbonate— $2\text{Zn} + 2\text{H}_2\text{SO}_4 + \text{H}_2\text{O} = 2\text{ZnSO}_4 + \text{H}_2 + \text{H}_2\text{O}$ . It is in colorless, transparent rhombic

crystals, or granular crystalline powder, odorless, astringent, metallic taste, efflorescent in dry air, soluble in 0.53 part water, 3 glycerin, insoluble in alcohol, heated parts with water of crystallization; contains, in uneffloresced crystals, 99.5 p. c. of pure salt. *Impurities*: Lead, copper, cadmium, arsenic, chloride, free acid. Should be kept in well-stoppered bottles. Dose, tonic, astringent, gr. 1–3 (.06–.2 Gm.), in pill, after meals; emetic, gr. 10–30 (.6–2 Gm.), in tepid water.

**PREPARATION.**—(Unoff.) *Unguentum Zinci Oleatis* (Br.), 20 p. c.

**PROPERTIES AND USES.**—Tonic, astringent, emetic, gastric catarrh, night-sweats, epilepsy, chorea, croup, diphtheria, dysentery, typhoid fever, atonic dyspepsia, heart palpitation, spasmodic asthma, whooping-cough. **Externally**—aphthæ, conjunctivitis, gonorrhœa, ophthalmia, throat and larynx affections, hemorrhages, nasal polypi, ulcers, tumors, lupus, eczema, itching, to remove urethral caruncles, condylomata, warty excrescences. Caustic paste (3j; 30 Gm. to glycerin 3j; 4 Cc.), caustic ointment (3j; 30 Gm. to lard 3ij; 8 Gm.), used as escharotic; injection, collyrium, and gargle ( $\frac{1}{8}$ – $\frac{1}{2}$  p. c.) are often useful.

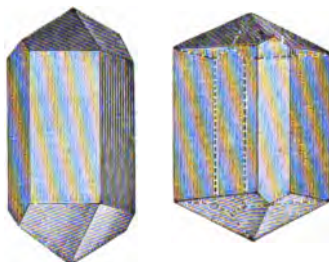


FIG. 454.

Zinc sulphate crystals.

**Zinci Valeras.** Zinc Valerate,  $\text{Zn}(\text{C}_5\text{H}_9\text{O}_2)_2 + 2\text{H}_2\text{O}$ .—(Syn., Zinci Valerianas, U. S. P. 1890, Zinc Valerianate, Valerianas (Valeras) Zincicus; Fr. Valérianate (Valérate) de Zinc; Ger. Zincum valerianicum, Baldriansaures Zinkoxyd.)

**Manufacture.**: Add together hot solutions of zinc sulphate and of sodium valerate, evaporate, crystallize —  $\text{ZnSO}_4 + 2\text{NaC}_5\text{H}_9\text{O}_2 = \text{Zn}(\text{C}_5\text{H}_9\text{O}_2)_2 + \text{Na}_2\text{SO}_4$ . It is in white, pearly scales, odor of valeric acid, sweetish, astringent, metallic taste, on exposure slowly loses valeric acid, soluble in 50 parts water, 35 alcohol, heated leaves residue of zinc oxide; contains 99 p. c. of pure salt. *Impurities*: Lead, copper, cadmium, arsenic, acetate, butyrate, chloride, sulphate. Should be kept in small, well-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.), in pill, mucilage, syrup.

**PROPERTIES AND USES.**—Antispasmodic, nervine, diabetes insipidus, neuralgia, epilepsy, chlorosis, nervous headache, vertigo, whooping-cough, convulsions, hysteria, chorea, cholera.

**Zinci Carbonas Præcipitatus.** Precipitated Zinc Carbonate,  $2\text{ZnCO}_3, 3\text{Zn}(\text{OH})_2$  (?).—(Syn., Zincum Carbonicum, Carbonas Zinci-cus; Br. Zinci Carbonas; Fr. Hydrocarbonas Zincicus, Zincum Sous-carbonate, Hydrocarbonate de Zinc; Ger. Zinkcarbonat, Kohlensaures Zinkoxyd.)

**Manufacture.**: Boil together solutions of zinc sulphate and sodium carbonate, filter, wash, dry— $5(\text{ZnSO}_4 + 7\text{H}_2\text{O}) + 5(\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O}) = 2\text{ZnCO}_3, 3\text{Zn}(\text{OH})_2 + 3\text{CO}_2 + 5\text{Na}_2\text{SO}_4 + 82\text{H}_2\text{O}$ . It is an impal-

pable white powder, of variable composition, odorless, tasteless, permanent, insoluble in water, alcohol; soluble in diluted acids with effervescence, also in ammonia water, ammonium carbonate; ignited yields 72 p. c. of zinc oxide. *Impurities*: Lead, copper, cadmium, arsenic, alkali.

**PROPERTIES AND USES.**—Astringent, protective, absorbent, chiefly externally for healing blisters, superficial sores, intertrigo, abrasions; in ointment, which now is substituted for the once popular Turner's cerate, made from impure native carbonate—calamine; may simply dust the powder on inflamed surfaces.

*Allied Salt:*

1. *Zinci Carbonas Impurus, Lapis Calaminaris. Calamine.*—Official 1830–1860.

**Zinci Oxidum. Zinc Oxide, ZnO.**—(Syn., Flores Zinci, Zinc-white, Nihil Album, Lana Philosophica; Fr. Oxydum Zincicum, Oxyde de Zinc; Ger. Zincum oxydatum (purum), Zinkoxyd, Philosophenwolle Zinkblumen.)

*Manufacture*: Heat zinc carbonate to redness in a crucible— $2\text{ZnCO}_3, 3\text{Zn(OH)}_2 + \text{heat} = 5\text{ZnO} + 2\text{CO}_2 + 3\text{H}_2\text{O}$ . It is a very fine amorphous, white or yellowish-white powder, free from gritty particles, odorless, tasteless, gradually absorbs  $\text{CO}_2$  from air, insoluble in water, alcohol, soluble in diluted acids without effervescence, also in ammonia water, ammonium carbonate T. S.; contains 99.5 p. c. of pure salt. *Assay*: Digest 1 Gm. with 30 Cc. normal hydrochloric acid V. S. until dissolved, add 2 drops methyl-orange T. S., should require 5.4 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. normal hydrochloric acid V. S. consumed corresponding to 4 p. c. of zinc oxide). *Impurities*: Lead, copper, cadmium, arsenic, sulphate, alkali. Dose, gr. 1–5 (.06–.3 Gm.), in pill, ter die.

**PREPARATION.**—1. *Unguentum Zinci Oxidi.* Ointment of Zinc Oxide. (Syn., Ointment of Zinc; Br. Unguentum Zinci; Fr. Unguentum de Nihilo Albo, Pommade d'Oxyde de Zinc, Cérat épulotique; Ger. Unguentum Zinci, Zinksalbe.)

*Manufacture*: 20 p. c. Rub zinc oxide 20 Gm. with equal weight of melted benzoinated lard, incorporate melted benzoinated lard q. s. 100 Gm., strain, stir until it congeals.

**PROPERTIES AND USES.**—Antispasmodic, astringent, chorea, epilepsy, whooping-cough, gastric and intestinal catarrhs, hysteria, spasmodic asthma, delirium tremens, colliquative sweats, diarrhoea, dysentery, diabetes insipidus. Externally—burns, scalds, fissures of nipples or anus, chancreoids, intertrigo, ulcers, leucorrhoea, skin eruptions, erysipelas, chronic ophthalmia, cosmetic, paint. Ointment is good form of application, having superseded the old Unguentum Tutiae (tutty) made from impure zinc oxide—tutty (1 in 5).

*Allied Salt:*

1. *Zinci Oxidum Impurum. Tutty, Tuttia.*—Official 1830–1840.

**Zinci Acetas.** Zinc Acetate,  $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 + 2\text{H}_2\text{O}$ .—(Syn., Fr. Acetas Zincicus, Acétate de Zinc; Ger. Zincum aceticum, Zinkacetat, Essigsaures Zinkoxyd.)

*Manufacture:* Dissolve zinc oxide (or carbonate) in acetic acid and water, boil, crystallize— $\text{ZnO} + 2\text{HC}_2\text{H}_3\text{O}_2 = \text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 + \text{H}_2\text{O}$ . It is in soft, white, 6-sided monoclinic plates, pearly lustre, faint acetous odor, astringent metallic taste, gradually effloresces, soluble in 2.5 parts water, 36 alcohol, decomposed by heat evolving acetone and other combustible vapors, leaving zinc oxide; contains in uneffloresced condition 99.5 p. c. of pure salt. *Impurities:* Lead, copper, cadmium, arsenic, chloride, sulphate. Should be kept in well-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

**PROPERTIES AND USES.**—Astringent, irritant, emetic; erysipelas, delirium, diarrhœa in typhoid, mostly externally in conjunctivitis, gonorrhœa ( $\frac{1}{8}$ – $\frac{1}{2}$  p. c.). The injection is prepared usually by adding zinc sulphate and lead acetate, each gr. 12 (.8 Gm.) to water  $\text{℥viii}$  (240 Cc.), which by double decomposition gives zinc acetate in solution and lead sulphate precipitated, this latter being most excellent for sheathing inflamed parts.

**Zinci Phenolsulphonas.** Zinc Phenolsulphonate,  $\text{Zn}(\text{C}_6\text{H}_4\text{SO}_3)_2 + 8\text{H}_2\text{O}$ .—(Syn., Zinci Sulphocarbolas, Zinc Sulphocarbonate, Zinc Phenol-para-sulphonate; Fr. Zinc Phenolsulfonique; Ger. Phenolsulfosaures Zink.)

*Manufacture.*—Heat a mixture of phenol and sulphuric acid, saturate the product with zinc oxide. It is in colorless, transparent, rhombic prisms or tabular crystals, odorless, astringent, metallic taste, effloresces on exposure, soluble in 1.7 parts water or alcohol, loses water of crystallization and is decomposed by heat, residue 14.6 p. c.; contains, in uneffloresced crystals, 99.5 p. c. of pure salt. *Impurities:* Lead, copper, cadmium, arsenic, chloride, sulphate. Should be kept in small, well-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

**PROPERTIES AND USES.**—Chiefly as a substitute for phenol (carbolic acid)—externally; antiseptic, astringent, stimulant for foul ulcers, mucous membrane inflammations, to prevent septicæmia in surgical operations (1–5 p. c. solutions); gonorrhœa, leucorrhœa, etc. (injection, 1–5 in 1,000).

**Zinci Stearas.** Zinc Stearate.—(Syn., Fr. Zinc Stéarate; Ger. Zinkstearat.)

*Manufacture:* Dissolve zinc acetate or sulphate in water, heat to  $71^\circ\text{C}$ . ( $160^\circ\text{F}$ .), and add slowly, with constant stirring, to solution of potassium stearate, wash precipitate, dry. It is a very fine white powder, tasteless, faint odor, resembling that of fat, insoluble in water, alcohol, ether, decomposed by heat, residue 15.5, chiefly zinc oxide; contains varying proportion of zinc palmitate. *Test:* 1. 0.5 Gm. heated with 9.5 Cc. distilled water + 0.5 Cc. hydrochloric acid, liberates stearic acid which floats on the surface. *Impurities:* Alkalies, alkali earths, chlorides.

PREPARATION.—1. *Unguentum Zinci Stearatis*. Ointment of Zinc Stearate. (Syn., Fr. Onguent de Stéarate de Zinc; Ger. Zinkstearat-salbe.)

*Manufacture*: 50 p. c. To white petrolatum 50 Gm., melted on water-bath, add zinc stearate 50, heat until mixture smooth, stir while cooling until it congeals.

PROPERTIES AND USES.—Antiseptic, astringent; gonorrhœa, atrophic rhinitis; apply in substance or combined with iodol, iodoformogen, or eucrophen (25 p. c.)

## CADMIUM.

$\text{Cd}^{\text{II}} = 111.5.$

(Official 1860–1880.)

The element cadmium (Gr. *καδμεία*, calamine,  $\text{ZnCO}_3$ —the two carbonates resemble and often occur together) is found sparingly in nature, associated with zinc ores, especially calamine—zinc carbonate. It is a white metal resembling tin, but heavier and more tenacious, crackles when bent, sp. gr. 8.7. The air has little effect upon it, but when heated it combines with 1 atom of oxygen, producing orange-red oxide,  $\text{CdO}$ ; it combines with chlorine, bromine, iodine, and sulphur.

*Tests for Cadmium Salts*: 1. With  $\text{H}_2\text{S}$  or ammonium sulphide get yellow-orange sulphide. 2.  $\text{NaOH}$  or  $\text{KOH}$  produces white precipitate, insoluble in excess, while that of ammonia water is soluble in excess. 3. Sodium or potassium carbonates precipitate white cadmium carbonate; the salts of cadmium are little used in medicine, the sulphide to a considerable extent as a pigment.

## PLUMBUM. LEAD.

$\text{Pb}^{\text{II}} = 206.5.$

(Official 1820–1830.) (Syn., Fr. Plomb; Ger. Blei.)

The element lead (AS. *lead*, heavy weight, plummet, L. *plumbum*) is obtained mostly from native sulphide (galena),  $\text{PbS}$ , by roasting in a reverberatory furnace: (1)  $\text{PbS} + \text{O}_2 = \text{PbO} + \text{SO}_2$ . (2)  $\text{PbS} + \text{O}_2 = \text{PbSO}_4$ . (3)  $\text{PbS} + 2\text{PbO} = 3\text{Pb} + \text{SO}_2$ . (4)  $\text{PbS} + \text{PbSO}_4 = 2\text{Pb} + 2\text{SO}_2$ ; or heat sulphide with iron— $\text{PbS} + \text{Fe} = \text{FeS} + \text{Pb}$ .

Lead is a soft, fusible, heavy metal, sp. gr. 11.45, entering into the alloys of solder, shot, Britannia metal, type-metal, etc.

*Tests for Lead Salts*: 1.  $\text{H}_2\text{S}$  or  $\text{NH}_4\text{SH}$  precipitates insoluble black sulphide. 2.  $\text{H}_2\text{SO}_4$  or soluble sulphate, precipitates white lead sulphate, insoluble in  $\text{HNO}_3$ . 3. Alkaline carbonates precipitate white basic lead carbonate insoluble in excess.

**Plumbi Oxidum.** Lead Oxide,  $\text{PbO}$ .—(Syn., Litharge, Oxide of Lead, Flowers of Lead, Semi-vitrified Lead Oxide, Plumbum Oxydatum, Plumbi Oxidum Semi-vitreum; Fr. Oxide de Plomb fondu, Protoxide de Plomb; Ger. Lithargyrum, Bleiglätte, Bleioxyd.)

*Manufacture*: Heat metallic lead to whiteness (400–450° C.; 752–842° F.) in the air, the oxygen of which combines with the lead, forming lead oxide, while any silver present remains unchanged; if heated only to fusion, get yellow amorphous *massicot*, a less oxidized form. It is a heavy, reddish-yellow powder, or in minute scales, odorless, tasteless, on exposure absorbs moisture and  $\text{CO}_2$ , insoluble in alcohol, nearly so in water, soluble in acetic acid, diluted  $\text{HNO}_3$ , or warm solutions of fixed alkali hydroxides; heated with charcoal yields the metal; contains 96 p. c. of pure salt. *Impurities*: Copper, iron, lead, silicates, barium sulphate, soluble and insoluble substances, carbonate, moisture. Should be kept in well-closed vessels.

PREPARATION.—1. *Liquor Plumbi Subacetatis*, 11 p. c.

PROPERTIES AND USES.—Chiefly externally and in combination, for burns, abraded surfaces, to allay inflammations; also enters into paints, flint glass, glazing of pottery, etc.; with KOH as caustic in condylomata, warts of glans penis and vagina, producing a superficial black slough. The emplastrum to prevent bed-sores, abrasions; if surface be large, plaster usually is substituted to avoid poisoning.

*Allied Salts*:

1. *Plumbi Oxidum Rubrum*. *Red Lead*,  $\text{Pb}_3\text{O}_4 = 2\text{PbO}, \text{PbO}_2$ .—Official 1840–1850. Obtained by heating massicot to 450° C. (840° F.), which gradually combines with more oxygen, forming red lead. It is a bright reddish-orange, granular, crystalline powder, becoming redder by more heat, then purple, finally black. At red heat gives up oxygen, becoming litharge; sp. gr. 8.7–9.1, contains 90.66 p. c. of lead, 9.34 p. c. of oxygen.

2. *Plumbi Carbonas*. *Lead Carbonate*,  $(\text{PbCO}_3)_2, \text{Pb}(\text{OH})_2$ .—Obtained by exposing lead sheets to air, acetic acid vapors, and carbon dioxide— $6\text{Pb} + 6\text{HC}_2\text{H}_3\text{O}_2 + \text{O}_6 + 2\text{CO}_2 = (\text{PbCO}_3)_2, \text{Pb}(\text{OH})_2 + 2\text{H}_2\text{O} + 3\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ , or by double decomposition between lead nitrate and sodium carbonate. It is a heavy white opaque powder or pulverulent mass, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in acetic acid or diluted  $\text{HNO}_3$  with effervescence. Used externally as a protective to irritated surfaces, also to constrict; erysipelas, erythema, intertrigo, ulcers, excoriated surfaces, eczema, burns, carbuncles; as paint, cosmetic; often produces chronic poisoning when applied to abraded parts; usually applied in fine powder or ointment (10 p. c.).

*Plumbi Nitras*. *Lead Nitrate*,  $\text{Pb}(\text{NO}_3)_2$ .—(Syn., *Plumbum Nitricum*, *Nitras (Azotas) Plumbicus*; Fr. *Azotate (Nitrate) de Plomb*; Ger. *Salpetersaures Bleioxyd*, *Bleisalpeter*.)

*Manufacture*: Nearly neutralize warm dilute nitric acid with lead oxide or carbonate, crystallize in a cool place— $\text{PbO} + 2\text{HNO}_3 = \text{Pb}(\text{NO}_3)_2 + \text{H}_2\text{O}$ . It is in colorless, transparent or opaque octahedral crystals, odorless, sweetish, astringent, metallic taste, permanent, soluble in 1.85 parts water, insoluble in alcohol, chars into lead oxide; contains 99 p. c. of pure salt. *Impurities*: Iron, copper, zinc, salts of alkalis, magnesium, calcium, etc.



**PROPERTIES AND USES.**—Discutient, deodorizer ; for the most part externally to correct fetor of gangrenous sores, offensive discharges from ear, nostril, rectum, vagina, ozæna, sore nipples, chapped hands, cracked lips, leucorrhœa, gonorrhœa, ulcers, impetigo, epithelioma. Ledoyen's disinfecting fluid (12 p. c.) is a good deodorant. Dose, gr.  $\frac{1}{2}$ –4 (.03–.26 Gm.).

**Plumbi Acetas.** Lead Acetate,  $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 + 3\text{H}_2\text{O}$ .—(Syn., Sugar of Lead, Acetas Plumbicus, Saccharum Saturni, Cerussa Acetata ; Fr. Acétate de Plomb, Sucre de Plomb, Sel of Saturne ; Ger. Plumbum aceticum, Bleiacetat, Essigsauers Bleioxyd, Bleizucker.)

**Manufacture :** Act upon lead oxide (1) with 30 p. c. acetic acid (2), evaporate, crystallize —  $\text{PbO} + 2\text{HC}_2\text{H}_3\text{O}_2 + \text{heat} = \text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 + \text{H}_2\text{O}$  ; or expose lead plates to the combined action of air and vinegar. It occurs in colorless, shining, transparent, monoclinic prisms, or plates, or heavy, white, crystalline masses, acetous odor, sweet, astringent, metallic taste, efflorescent, absorbs  $\text{CO}_2$ , soluble in 2 parts water, 30 alcohol ; contains at least 99.5 p. c. of pure salt. When heated loses water of crystallization (14.26 p. c.) and acetic acid, separating into carbon dioxide, acetone, metallic lead mixed with oxide and carbonate. **Impurities :** Iron, copper, zinc, carbonate, salts of alkalies, magnesium, calcium, etc. Should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{2}$ –4 (.03–.26 Gm.), usually with opium.

FIG. 455.



Lead acetate crystal.

**PREPARATIONS.**—1. *Liquor Plumbi Subacetatis.* Solution of Lead Subacetate. (Syn., Goulard's Extract, Acetum Plumbicum (Saturni), Plumbum Hydrico-aceticum Solutum ; Br. Liquor Plumbi Subacetatis Fortis ; Fr. Sous-acétate de Plomb liquide, Extrait de Saturne (de Goulard), Vinaigre de Plomb (de Saturne) ; Ger. Liquor Plumbi subacetici, Bleiessig.)

**Manufacture :** To lead oxide 11 Gm. add, with constant stirring, lead acetate 18 Gm., previously dissolved in 70 Cc. boiling distilled water, boil half an hour, stirring occasionally, cool, filter, add distilled water, previously boiled and cooled, q. s. 100 Gm. It is a clear, colorless, aqueous liquid, odorless, sweetish, astringent taste, alkaline reaction, on exposure absorbs carbon dioxide, causing white precipitate, sp. gr. 1.235 ; contains in solution 25 p. c. of lead subacetate (basic lead acetate),  $\text{Pb}_2\text{O}(\text{CH}_3\text{COO})_2$ . **Test :** 1. When added to acacia solution get dense, white precipitate (dis. from normal lead acetate). **Assay :** Dilute 10 Gm. with boiled and cooled distilled water q. s. 100 Cc., of this add 13.6 Cc. to 35 Cc.  $\frac{\text{N}}{10}$  oxalic acid V. S., shake, add distilled water q. s. 50 Cc., shake, after precipitate settles, 10 Cc. clear solution, after diluting with 50 Cc. water + 5 Cc. sulphuric acid, should require 2 Cc.  $\frac{\text{N}}{10}$  potassium permanganate V. S. to produce permanent pink tint (each Cc. of V. S. corresponding to 1 p. c. of pure salt). Should be kept in well-stoppered bottles.

Preps.: 1. *Liquor Plumbi Subacetatis Dilutus*. Diluted Solution of Lead Subacetate. (Syn., Lead Water, Aqua Plumbica (Saturnina); Fr. Eau de Saturne, Eau blanche; Ger. Aqua Plumbi, Bleiwasser, Kühlwasser.)

*Manufacture*: Mix solution of lead subacetate 4 Gm. with distilled water, previously boiled and cooled, q. s. 100 Gm. It is an aqueous liquid containing 1 p. c. of lead subacetate. Should be kept in well-stoppered bottles.

2. *Ceratum Plumbi Subacetatis*. Cerate of Lead Subacetate. (Syn., Goulard's Cerate, Ointment of Glycerin of Lead Subacetate; Br. Unguentum Glycerini Plumbi Subacetatis; Fr. Ceratum cum Subacetate Plumbico, Cérat Saturné—de Saturné—de Goulard; Ger. Unguentum Plumbi, Bleisalbe, Bleicerat.)

*Manufacture*: To melted wool-fat 20 Gm., in warm mortar, add gradually solution of lead subacetate 20 Gm., incorporate by trituration, add white petrolatum 38 Gm., paraffin 20 Gm., previously melted, and in which camphor 2 Gm. has been dissolved, mix thoroughly.

2. *Emplastrum Plumbi*. Lead Plaster. (Syn., Diachylon Plaster, Litharge Plaster, Emplastrum Diachylon Simplex, Emplastrum Album Coctum; Fr. Emplastrum Simplex, Emplâtre simple (de Plomb—de Litharge); Ger. Emplastrum Lithargyri (Simplex), Bleipflaster, Emplastrum Cerussæ, Bleiweisspflaster.)

*Manufacture*: Dissolve soap 100 Gm. in hot water 350 Cc., strain; dissolve lead acetate 60 Gm. in hot water 250 Cc., filter into warm soap solution while stirring; wash precipitate with hot water, knead out remaining water on warm slab, make into cylindrical rolls, wrap in paraffined paper.

Preps.: 1. *Unguentum Diachylon*. Diachylon Ointment. (Syn., Unguentum Plumbi Hebræ, Hebra's Lead Ointment; Fr. Onguent (Pommade de) Diachylon; Ger. Bleipflastersalbe, Diachylonsalbe.)

*Manufacture*: Melt lead plaster 50 Gm., add olive oil 49, partly cool, add oil of lavender flowers 1, stir until it congeals; should be prepared extemporaneously.

2. *Emplastrum Adhæsivum*. Adhesive Plaster. (Syn., Emplastrum Resinæ, Resin Plaster; Fr. Emplâtre résineux (adhésif); Ger. Emplastrum adhæsivum, Heftpflaster.)

*Manufacture*: Melt rubber 2 Gm. at 150° C. (302° F.), add petrolatum 2 Gm., continue heat until rubber dissolved, add lead plaster 96 Gm., heat until liquefied, strain, stir while cooling.

Preps.: 1. *Emplastrum Belladonnæ*, 70 p. c. 2. *Emplastrum Capsici*, q. s. 3. *Emplastrum Opii*, 90 p. c.

3. *Emplastrum Hydrargyri*, 59 p. c. 4. *Emplastrum Saponis*, 90 p. c.

*Unoff. Preps.*: *Unguentum Plumbi Acetatis* (Br.), 4 p. c. *Glycerinum Plumbi Subacetatis* (Br.), lead acetate 15.3 p. c. + lead oxide 10 p. c. *Pilula Plumbi cum Opio* (Br.), lead acetate 75 p. c. + opium 12.5 p. c.

*Suppositoria Plumbi Composita* (Br.)—each contains lead acetate 3 gr. (.2 Gm.), + opium 1 gr. (.06 Gm.).

**PROPERTIES AND USES.**—Astringent, sedative, large doses irritant poison, diarrhoea, dysentery, internal hemorrhage, aneurism, tympanites, epilepsy, neuralgia, chorea, hysteria, bronchitis, whooping-cough, sweats. Externally—contusions, excoriations, fractures, sprains, gonorrhoea, leucorrhoea, chronic eczema, eye affections (conjunctivitis, etc.; wash or drops,  $\frac{1}{2}$ – $\frac{1}{2}$  p. c. in distilled water). Cerate—for excoriations, burns, scalds, chilblains, skin eruptions, acute inflammations.

**Plumbi Iodidum.** Lead Iodide,  $\text{PbI}_2$ .—(Syn., Ioduretum Plumbicum; Fr. Iodure de Plomb; Ger. Plumbumjodatum, Jodblei.)

**Manufacture:** Mix equal quantities (120 Gm.) of lead nitrate and potassium iodide, each dissolved separately in sufficient water (500 Cc.), filter, wash, dry precipitate— $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} = \text{PbI}_2 + 2\text{KNO}_3$ . It is a heavy, bright yellow powder, odorless, tasteless, permanent, soluble in fixed alkali solutions, 1,300 parts water, 200 boiling water, decomposed by heat; contains 99 p. c. of pure salt. **Impurities:** Nitrate, acetate, chromate, soluble and insoluble foreign salts. Should be kept dark, in well-stoppered bottles. Dose, gr.  $\frac{1}{2}$ –4 (.03–.26 Gm.), ter die, in pill.

**PREPARATIONS.**—(Unoff.) *Ointment*, 10 p. c. *Emplastrum Plumbi Iodidi* (Br.), 10 p. c.

**PROPERTIES AND USES.**—Resolvent, tuberculous diseases, scrofulous tumors, ulcers, indolent swellings, malarial enlargement of spleen; ointment, best form externally.

**Poisoning:** From any of the lead salts, when acute have burning, sweetish taste, thirst, vomiting (whitish fluid, due to lead chloride), abdominal colic (relieved by pressure), abdominal muscles rigid, cramps in legs, paralysis of extremities, rapid, weak pulse, livid face, stupor, constipation, feces black (lead sulphide), cold skin, collapse, giddiness, coma, convulsions, death. Give magnesium or sodium sulphate, then induce vomiting, follow with purgative enema, demulcent drinks, egg-white, milk, stimulants, opium; for lead colic hot fomentation, opiates, evacuants; for chronic lead-poisoning (constipation and dark blue line along margin of gums, wrist-drop) give iodides to saturation (Na, K, Ca), sulphurous baths, calomel, sulphuric acid, lemonade, friction to muscles, electricity, strychnine.

## CUPRUM. COPPER.

$\text{Cu}^{\text{II}} = 63.2.$

(Official 1870–1880.)

The element copper (Gr. *Κύπρος*, Cyprus, Mediterranean island, whence the Romans got their best copper; L. *cuper*, *cuprum*, contr. of Cyprium) enters into alloys—brass, German silver, bell-metal, bronze, gun-metal, gold, silver, and occurs in nature as metal, sulphide, oxide, sulphate, carbonate, phosphate, and arsenate. The most

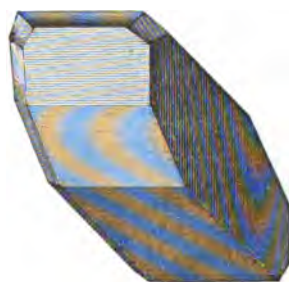
common ore—copper pyrites,  $\text{Cu}_2\text{S}, \text{Fe}_2\text{S}_3$ , has brass or gold lustre, but copper glance,  $\text{Cu}_2\text{S}$  (dark gray), and malachite,  $\text{Cu}_2\text{CO}_3, \text{Cu}(\text{OH})_2$  (beautiful green), yield considerable metal. Copper is red in color, malleable, sp. gr. 8.92–8.95, good conductor of heat and electricity, by exposure becoming coated with green film of subcarbonate; forms two oxides: 1. Red *cuprous*,  $\text{Cu}_2\text{O}$ ; 2. Black—*cupric*,  $\text{CuO}$ .

*Tests for Copper Salts:* 1.  $\text{H}_2\text{S}$  or  $\text{NH}_4\text{SH}$  precipitates black cupric sulphide. 2.  $\text{KOH}$  or  $\text{NaOH}$  precipitates blue cupric hydroxide,  $\text{Cu}(\text{OH})_2$ , which by boiling becomes dark brown cupric oxide,  $\text{CuO}$ ; but with  $\text{NH}_4\text{OH}$  get only dark blue solution—an ammonio-copper compound. 3. Potassium ferrocyanide precipitates reddish-brown cupric ferrocyanide,  $\text{Cu}_2\text{Fe}(\text{CN})_6$ . 4. Polished iron, steel, or zinc immersed in an acidified copper solution becomes coated with metallic copper.

**Cupri Sulphas.** **Copper Sulphate**,  $\text{CuSO}_4 + 5\text{H}_2\text{O}$ .—(Syn., Cupric Sulphate, Blue Vitriol, Blue Stone, Roman Vitriol, Cuprum Vitriolatum, Sulfas Cupricus; Fr. Sulfate de Cuivre, Vitriol bleu, Couperouse bleu; Ger. Cuprum sulfuricum, Kupfer-(vitriol)sulfat, Blauer (vitriol) Galitzenstein, Schwefelsaures Kupfer.)

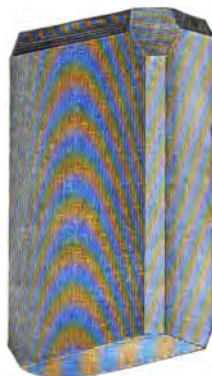
*Manufacture:* Heat copper with sulphuric acid, shake with hot water, evaporate, crystallize— $\text{Cu} + 2\text{H}_2\text{SO}_4 = \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2$ , or may heat copper pyrites. It is in large, transparent, deep blue,

FIG. 456.



Copper sulphate crystal.

FIG. 457.



Copper acetate crystal.

triclinic crystals, odorless, nauseous metallic taste, efflorescent, soluble in 2.2 parts water, 400 alcohol, 3.5 glycerin, heated loses 36.1 p. c., finally  $\text{SO}_2$  and  $\text{O}$ , leaving black cupric oxide; contains 99.5 p. c. of pure salt. *Impurities:* Heavy metals, iron, aluminum. Dose, tonic, astringent, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.), in pill; emetic, gr. 2–10 (.13–.6 Gm.), mixed with sugar or in solution, repeated in 15 minutes if necessary.

**PROPERTIES AND USES.**—Astringent, tonic, irritant, escharotic, emetic, stimulant. Once used for epilepsy, and now for chronic

ulcerative diarrhoea, dysentery, cholera, croup, malignant sore throat. Externally—foul ulcers, caustic for warts, fungoids, callous, bleeding surfaces, chancres, ulcerative stomatitis, gangrene of pharynx, mercurial sore mouth, conjunctivitis, acne, eczema. Convenient forms for application are the crystal, cuprum aluminatum (*lapis divinus*, *pierre divine*, *pierre ophthalmique*, in pencils or stick), and the wash ( $\frac{1}{2}$ –1–2 p. c.). Used also as a test for diabetic sugar, and in making many green pigments, as Scheele's green (arsenite), Paris green (aceto-arsenite), Bremen green (hydroxide), and others.

*Poisoning*: Large doses gastro-intestinal irritant; long-continued small doses cause bronchial catarrh, colic, vomiting, diarrhoea (bloody, mucous), tenesmus, salivation, anæmia, wasting, jaundice, fatty liver, nervousness, thirst, hurried respiration, delirium, small, rapid pulse, convulsions, coma. Give egg-white to form insoluble compound, then emetics at once, also reduced iron, weak solution potassium ferrocyanide (chemical antidote), magnesium oxide, tannin, opium, again empty stomach and saturate system with potassium iodide, heat, stimulants.

*Incompatibles*: Alkalies, their carbonates, sulphides, mineral salts (except sulphates), lime water, iodides, vegetable astringents.

*Allied Salts*:

1. *Cupri Acetas*. *Copper Acetate*,  $\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$ .—Official 1880–1890. Obtained by dissolving verdigris in acetic acid, or precipitate solution of lead acetate with copper sulphate. It is in deep bluish-green rhombic prismatic crystals, efflorescent, odorless, nauseating metallic taste, soluble in 15 parts water, 135 alcohol. *Impurities*: Alkalies, alkaline earths, iron, lead, zinc, chloride, sulphate, calcium. Dose, gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.). Solutions should be  $\frac{1}{2}$ –1 p. c.

PROPERTIES AND USES.—Skin diseases, scrofula, intermittents, epilepsy, in collyria, aphthous ulcers, gonorrhoea.

2. *Cupri Subacetas*. *Copper Subacetate*. *Verdigris*.—Official 1830–1880.  $\text{Cu}_2\text{O}(\text{C}_2\text{H}_3\text{O}_2)_2$ . Obtained thus: grape husks are subjected to acetic fermentation, and then are stratified in earthen vessels with sheets of copper, where they are allowed to remain 4 to 6 weeks, as a result of which the sheets upon drying and exposing to air for several weeks are coated with verdigris, which is scraped off and the plates replaced for a second action, etc.; the verdigris is dried in the sun, and occurs in masses, having bluish-green color, composed of many silky crystals, coppery taste, insoluble in alcohol, soluble in ammonia, HCl, diluted  $\text{H}_2\text{SO}_4$ , partially in water.

PROPERTIES AND USES.—Stimulant, escharotic; externally—indolent ulcers, tuberculated skin affections, warts, chancres. Not used internally.

3. *Cuprum Ammoniatum*. *Ammoniated Copper*,  $\text{Cu}(\text{NH}_3)_4\text{SO}_4 \cdot \text{H}_2\text{O}$ .—Obtained by rubbing together copper sulphate 4, ammonium carbonate 3, until effervescence ceases, dry. Deep azure-blue color, ammoniacal odor. Epilepsy, chorea. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.). *Copper Arsenite* (Scheele's green) may be employed in cholera-infantum, diarrhoea.

## BISMUTHUM. BISMUTH.

Bi<sup>III</sup> = 208.9.

(Official 1830–1880.)

The element bismuth (Ger. *wismuth*, fr. *riesematte*, a beautiful shadow, from its variegated tints when fresh) is found mostly in metallic state as small veins in rocks, occurs also as sulphide; it is obtained from the ore by heating until sufficiently mobile to separate from its earthy matter. Bismuth is brittle, crystalline, brilliant, with silver color and pinkish tinge, forms several alloys and many medicinal salts, some being official.

*Tests for Bismuth Salts.*—1.  $H_2S$  or  $NH_4SH$  precipitates black bismuth sulphide,  $Bi_2S_3$ , insoluble in excess. 2. Acid bismuth solutions poured into water form white precipitate of subsalts or bismuthyl salts. 3. Ammonium or sodium hydroxide or carbonate precipitates white bismuth hydroxide,  $Bi(OH)_3$ , or bismuthyl carbonate.

**Bismuthi Subnitrates. Bismuth Subnitrate,  $BiONO_3 \cdot H_2O$  (?)**.—(Syn., White Bismuth, Bismuthum Hydrico-nitricum, Magisterium Bismuthi, Subazotas (Subnitrates) Bismuthicus, Bismuthyl Nitrate; Br. Bismuth Oxynitrate; Fr. Sous-azotate (Sous-nitrate) de Bismuth; Ger. Bismutum subnitricum, Basisches Wismutnitrate (Salpetersaures Wismutoxyd), Wismutsubnitrat.)

*Manufacture:* Dissolve purified bismuth (1) in nitric acid (5), heated to  $90^\circ C.$  ( $194^\circ F.$ ), let stand several days, decant, evaporate to crystallization; rub uniformly crystals (1) with water (4) and pour while stirring into boiling water (21), drain, wash, dry— $Bi_2 + 8HNO_3 = 2Bi(NO_3)_3 + 2NO + 4H_2O$ ;  $6Bi(NO_3)_3 + 10H_2O = 5BiONO_3 \cdot H_2O + Bi(NO_3)_3 + 10HNO_3$ . It is a heavy white powder of varying chemical composition, odorless, almost tasteless, permanent, insoluble in water, alcohol, soluble in nitric or hydrochloric acid, heated loses 3 p. c. moisture, when to redness evolves nitrous vapors, and should yield 80 p. c. of pure bismuth oxide (yellow residue soluble in nitric or hydrochloric acid, and blackened by hydrogen sulphide). *Assay:* 2 Gm. ignited until all nitrous vapors evolved, the residue of bismuth oxide when cold should weigh 1.6 Gm. *Impurities:* Lead, copper, silver, arsenic, chlorides, sulphates, carbonate, alkalies and alkali earths, insoluble foreign salts. Dose, gr. 5–30 (.3–2 Gm.), ter die, in water on empty stomach.

**PROPERTIES AND USES.**—Sedative, astringent, almost insoluble in the system, acts mechanically by coating the gastric mucous membrane with a protective film, thus preventing irritation from contents. Used in diseases of the stomach—gastralgia, subacute gastritis, pyrosis, irritated intestinal mucous membrane, diarrhoea, dysentery, cholera infantum; injection in gonorrhoea, leucorrhoea, dysentery, rectal irritation, coryza; the powder locally in burns, variola, eczema, fissures, chapped nipples, lips, hands, intertrigo, ozæna, fetid feet, whooping-cough; also a test for diabetic sugar.

*Allied Salt:*

1. *Bismuthi Oxidum*. *Bismuth Oxide*,  $\text{Bi}_2\text{O}_3$ .—Obtained by boiling 5 minutes bismuth subnitrate in solution of sodium hydroxide, filter, dry precipitate— $2(\text{BiONO}_3, \text{H}_2\text{O}) + 2\text{NaOH} = 2\text{Bi}(\text{OH})_3$  or  $(\text{Bi}_2\text{O}_3, 3\text{H}_2\text{O}) - 2\text{NaNO}_3$ . Occurs as a dull lemon-yellow powder, resembling the subnitrate in medicinal properties, doses, and uses.

*Bismuthi Citras*. *Bismuth Citrate*,  $\text{BiC}_6\text{H}_5\text{O}_7$ .—(Syn., Bismuthum Citricum, Citras Bismuthicus; Fr. Citrate de Bismuth; Ger. Wismut citrat, Citronensaures Wismutoxyd.)

*Manufacture*: Bismuth subnitrate 100 Gm., citric acid 75 Gm., distilled water 400 Cc.—heat on water-bath with frequent stirring until a drop is clear in ammonia water, then add distilled water 5,000 Cc., wash, dry precipitate— $(\text{BiONO}_3, \text{H}_2\text{O}) + \text{H}_3\text{C}_6\text{H}_5\text{O}_7 + \text{H}_2\text{O} = \text{BiC}_6\text{H}_5\text{O}_7 + \text{HNO}_3 + 3\text{H}_2\text{O}$ . It is a white amorphous or crystalline powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in ammonia water and alkaline citrate solutions; should yield 58–60 p. c. of pure bismuth oxide. *Assay*: 1 Gm. ignited, cooled, — 5 Cc. nitric acid, drop by drop, warmed until dissolved, evaporated, ignited, should give residue of 0.58–0.6 Gm. *Impurities*: Lead, copper, silver, arsenic, chlorides, sulphates, nitrate, etc. Dose, gr. 1–3 (.06–.2 Gm.).

*PREPARATIONS*.—1. *Bismuthi et Ammonii Citras*. Bismuth and Ammonium Citrate,  $\text{BiC}_6\text{H}_5\text{O}_7, \text{NH}_4\text{OH}, 2\text{H}_2\text{O}(\text{?})$ . (Syn., Bismuthi Ammonio-citras, Bismuthum Citricum Ammoniatum; Fr. Citrate de Bismuth (Ammoniacal) et d'Ammoniaque; Ger. Citronensaures Wismut (oxyd) ammonium.)

*Manufacture*: Rub to a paste bismuth citrate 100 Gm. with distilled water 200 Cc., heat gradually, add ammonia water until salt dissolved and liquid neutral, filter, evaporate to syrupy consistence, spread upon glass plates so as to dry in scales. It is in shining, pearly or translucent scales, odorless, metallic taste, becoming opaque on exposure with loss of ammonia, soluble in water, sparingly in alcohol; should yield 48 p. c. of pure bismuth oxide. *Assay*: Same as bismuth citrate, except residue should weigh 0.48 Gm. *Impurities*: Same as bismuth citrate. Should be kept dark, in well-stoppered, amber-colored bottles. Dose, gr. 1–4 (.06–.26 Gm.).

*Unoff. Prep.*: *Liquor Bismuthi et Ammonii Citratis* (Br.), 7 p. c., dose, ʒss–1 (2–4 Cc.).

*PROPERTIES AND USES*.—Citrate may be employed like subnitrate, as astringent, irritant, but made official for preparing the double soluble salt (bismuth and ammonium citrate), which owing to greater solubility has more rapid action, is more astringent and irritating than other bismuth salts; employed in chronic serous diarrhœas, but never where acute inflammation exists; not nearly so valuable as the insoluble salts.

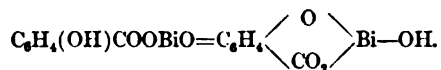
*Bismuthi Subcarbonas*. *Bismuth Subcarbonate*,  $(\text{BiO})_2\text{CO}_3, \text{H}_2\text{O}(\text{?})$ .—(Syn., Pearl White, Bismuthum Subcarbonicum, Subcarbonas

Bismuthicus, Bismuthyl Carbonate; Br. Bismuthi Carbonas, Bismuth Oxycarbonate; Fr. Sous-carbonate de Bismuth; Ger. Basisches Kohlensaures Wismutoxyd, Wismutsubcarbonat.)

*Manufacture*: Dissolve purified bismuth in nitric acid diluted, filter, precipitate with ammonia water, wash and dissolve precipitate in nitric acid, pour this into solution of sodium carbonate, filter, wash and dry precipitate. (1)  $\text{Bi} + 4\text{HNO}_3 = \text{Bi}(\text{NO}_3)_3 + \text{NO} + 2\text{H}_2\text{O}$ . (2)  $2\text{Bi}(\text{NO}_3)_3 + 3\text{Na}_2\text{CO}_3 + \text{H}_2\text{O} = (\text{BiO})_2\text{CO}_3 \cdot \text{H}_2\text{O} + 6\text{NaNO}_3 + 2\text{CO}_2$ . It is a white or yellowish powder, varying composition, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in  $\text{HNO}_3$  or  $\text{HCl}$ , with effervescence, heated to redness loses water and carbon dioxide, yielding residue of 90 p. c. of pure bismuth oxide. *Assay*: 1 Gm. ignited, leaves residue 0.9 Gm. *Impurities*: Lead, copper, silver, arsenic, alkalies and alkali earths, chlorides, sulphate, subnitrate. Dose, gr. 5–30 (.3–2 Gm.).

**PROPERTIES AND USES.**—Intended as a substitute for subnitrate, as it is a little more soluble, hence less likely to constipate and blacken the stools; but as these are disadvantages, it is not much used.

**Bismuthi Subsali-cylas. Bismuth Subsali-cylate.**—(Syn., Bismuth Salicylas, Bismuth Oxysali-cylate, Basic Bismuth Salicylate; Ger. Bismutum subsali-cylicum, Basisches Wismutsali-cylat.)



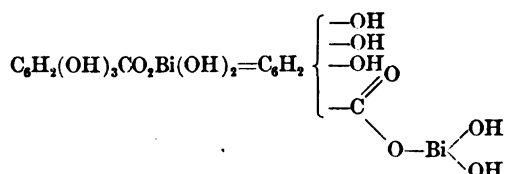
*Manufacture*: Digest in a warm place for two days, frequently stirring, bismuth subnitrate 500 Gm. with distilled water 1,000 Cc., add strong ammonia water 50 Cc., wash precipitate ( $\text{Bi}_2\text{O}_3$ ), and while moist add a little distilled water and 125 Gm. salicylic acid, let stand with frequent stirring 48 hours, wash precipitate, dry. It is a white or nearly white, amorphous or crystalline powder, odorless, tasteless, almost insoluble in cold water; when boiled in it forms more basic bismuth salicylate, heated loses 1 p. c. of water, if to redness chars, leaving yellow residue 62–64 p. c. of pure bismuth oxide, soluble in hydrochloric or nitric acid, blackened by ammonium sulphide T. S. *Assay*: 1 Gm. ignited, cooled, + 5 Cc. nitric acid, drop by drop, warmed until dissolved, evaporated, ignited, should give residue of 0.62–0.64 Gm. (bismuth oxide). *Impurities*: Lead, copper, silver, arsenic, nitrate, free salicylic acid, etc. Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Internal antiseptic, astringent; passes through stomach unchanged, but is decomposed in small intestine, where it acts as an unirritating antiseptic. Diarrhoea, typhoid, catarrh of alimentary tract, mucous membrane inflammation, gastric disorders; externally like iodoform—wounds, etc.

**Bismuthi Subgallas. Bismuth Subgallate.**—(Syn. Dermatol,



Bismuthyl Gallate; Fr. Sousgallate de Bismuth; Ger. Bismuthum subgallicum, Basisches Wismutgallat, Wismutsubgallat.)



**Manufacture:** Dissolve bismuth subnitrate 15 parts, in glacial acetic acid 30, adding water 200–250, filtering; to filtrate, constantly stirring, add aqueous solution gallic acid (5 in 250), wash precipitate by decantation, dry. It is an amorphous, bright yellow powder, variable chemical composition, odorless, tasteless, permanent, insoluble in water, alcohol, ether, readily soluble with decomposition in hydrochloric, nitric, and sulphuric acids if heated, solutions of alkali hydroxides; heated loses 5–7 p. c. of water, if to redness chars into yellow residue of 52–57 p. c. of pure bismuth oxide, soluble in hydrochloric and nitric acids, blackened by ammonium sulphide T. S. **Assay:** 1 Gm. ignited, cooled, + 5 Cc. nitric acid, drop by drop, warmed until dissolved, evaporated, ignited, should give residue of 0.52–0.57 Gm. **Impurities:** Lead, copper, silver, arsenic, nitrate, free gallic acid, etc. **Dose,** gr. 5–30 (.3–2 Gm.).

**PROPERTIES AND USES.**—Antiseptic. Like iodoform, but has sedative, astringent, drying, and antibacterial effects upon wounds, ulcers, eczemas; fermentative dyspepsia, diarrhoea of tuberculosis and typhoid fever; apply in powder, ointment (1 + 10 vaseline), gauze (10 p. c.).

**Incompatibles:** Acids.

Other important salts of bismuth are: the oxychloride, subiodide, tannate, valerate (valerianate).

## ARGENTUM. SILVER.

$$\text{Ag}^1 = 107.7.$$

(Official 1830–1880.)

The element silver (AS. *seolfer*; L. *argentum*; Gr. *ἀργυρος*, white—i. e., its bright, shining color) occurs natively as metal and sulphide; the latter, being along with lead sulphide—argentiferous galena—is simply roasted, when lead oxidizes into litharge and pure silver separates. Silver may also be obtained by amalgamation—dissolving it in mercury and distilling the amalgam, when mercury, being volatile, passes over, and silver remains. It is the whitest metal, best conductor of heat and electricity, takes brilliant polish, malleable, ductile, sp. gr. 10.4–10.5.

**Tests for Silver Salts:** 1.  $\text{H}_2\text{S}$  or  $\text{NH}_4\text{SH}$  precipitates black silver sulphide,  $\text{Ag}_2\text{S}$ . 2. Hydrochloric acid, or any soluble chloride, precipitates white curdy silver chloride,  $\text{AgCl}$ , insoluble in hot  $\text{HNO}_3$ , but soluble in ammonia water. 3. Alkaline hydroxides precipitate

brown silver oxide,  $\text{Ag}_2\text{O}$ , soluble in ammonia water. 4. Metallic copper, zinc, or iron precipitates metallic silver.

**Argenti Nitras.** Silver Nitrate,  $\text{AgNO}_3$ .—(Syn., Lunar Caustic; Fr. Azotas (Nitras) Argenticus, Azotate (Nitrate) d'Argent, Nitre lunaire; Ger. Argentum nitricum (Crystallizatum), Silbernitrat, Salpetersaures Silberoxyd, Silbersalpeter.)

**Manufacture:** Dissolve silver in nitric acid by heat, evaporate dry to expel free acid, dissolve dry mass in hot water, crystallize— $3\text{Ag} + 4\text{HNO}_3 = 3\text{AgNO}_3 + \text{NO} + 2\text{H}_2\text{O}$ . It is in colorless, transparent, tabular, rhombic crystals, gray or grayish-black on exposure to light in presence of organic matter, odorless, bitter, caustic, strongly metallic taste, soluble in 0.54 part water, 24 alcohol, melts at  $200^\circ \text{C}$ . ( $392^\circ \text{F}$ .); contains 99.9 p. c. of pure salt. **Assay:** 0.5 Gm. + 10 Cc. distilled water, + 30 Cc.  $\frac{\text{N}}{10}$  sodium chloride V. S., + 3 drops potassium chromate T. S., should require 0.4 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to give liquid permanent red color. **Impurities:** Copper, lead, foreign salts. Should be kept dark, in dark amber-colored bottles. Dose, gr.  $\frac{1}{4}$ — $\frac{1}{2}$  (.008–.03 Gm.), ter die, in pill with bitter extracts, but not with bread containing salt, as this hastens decomposition; best given on empty stomach.

**PREPARATIONS.**—1. *Argenti Nitras Mitigatus*. Mitigated Silver Nitrate. (Syn., Argenti Nitras Dilutus, U. S. P. 1890, Mitigated Caustic, Nitrate of Silver and Potassium, Argentum Nitricum Fusum Mitigatum, Lapis Infernalis Nitratus; Fr. Azotate d'Argent mitigé, Pierre Infernale diluée; Ger. Argentum nitricum cum Kalio nitrico, Saltpeterhaltiges Silbernitrat, Saltpeterhaltiger Höllenstein.)

**Manufacture:** Silver nitrate 30 Gm., potassium nitrate 60 Gm., melt and mould; contains  $33\frac{1}{2}$  p. c. of pure silver nitrate. It is white, hard, solid, in pencils or cones, fracture granular, gray or grayish-black on exposure to light and organic matter, odorless, caustic metallic taste, soluble in water, alcohol. **Assay:** 1 Gm. + 10 Cc. distilled water, + 20 Cc.  $\frac{\text{N}}{10}$  sodium chloride V. S., + 3 drops potassium chromate T. S., should require 0.3 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to give liquid permanent red color. **Impurities:** Copper, lead, bismuth. Should be kept dark, in dark amber-colored bottles. Used when mild action desired.

2. *Argenti Nitras Fusus*. Moulded Silver Nitrate. (Syn., Lunar Caustic, Lapis Infernalis; Br. Argenti Nitras Induratus, Toughened Caustic; Fr. Azotas (Nitras) Argenticus Fusus, Azotate (Nitrate) d'Argent fondu, Pierre infernale; Ger. Argentum nitricum (fusum), Gehärteter Höllenstein, Geschmolzenes Salpetersaures Silberoxyd.)

**Manufacture:** Silver nitrate 100 Gm., hydrochloric acid 4 Gm., melt and mould. It is white, hard, solid, in pencils or cones, fracture fibrous, gray or grayish-black on exposure to light and organic matter, odorless, caustic, metallic taste, soluble (except 5 p. c. silver chloride) in 0.54 part water, 24 alcohol; residue from water soluble in ammonia water; contains 94.8 p. c. of pure salt. **Assay:** 0.5 Gm. + 10 Cc. distilled water, + 30 Cc.  $\frac{\text{N}}{10}$  sodium chloride V. S., + 3 drops potassium chromate T. S., should require 1.9 Cc.  $\frac{\text{N}}{10}$  silver nitrate V. S. to give

liquid permanent red color. The hydrochloric acid is added simply to toughen the compound, so that it may be handled more readily without breaking. Should be kept dark, in dark amber-colored bottles.

**PROPERTIES AND USES.**—Alterative, stimulant, astringent (only externally), hæmostatic, escharotic (but does not act deeply), sedative, epilepsy, chronic spinal inflammation, locomotor ataxia, spasmodic tabes, ulcerations of alimentary tract, subacute gastritis, pyrosis, ulcer of stomach, chronic diarrhœa, catarrh of the gall-duets, typhoid fever, neuralgia, dysentery, cholera, vomiting of pregnancy, chronic jaundice, abnormal heart-action, bronchitis. Externally—diphtheritic exudations, croup (10 p. c.), chronic ulceration, simple inflammation, chronic laryngitis (1–5 p. c.), aphonia, whooping-cough, sore throat of speakers, tubercular and syphilitic tonsillitis, enlarged lymphatic glands, abscesses, iritis, sciatica, conjunctivitis ( $\frac{1}{2}$ –1 p. c.), corneal ulcers, hemorrhages from leech-bites, bed-sores, poisoned and other wounds, mercurial sore mouth, chancre, smallpox, herpes, intertrigo, burns, erysipelas, gonorrhœa, leucorrhœa, otorrhœa, neck of bladder inflammation, vesical catarrh, urethral strictures, involuntary seminal emissions, enlarged prostate, corns, rectal ascarides.

Also much used in making indelible ink, dyes for hair, beard, etc. When used on the hair for a long time the system usually absorbs sufficient to produce poisonous symptoms, with permanent constitutional weakness. The stains may be removed by applying a solution of potassium cyanide, or potassium iodide, or tincture iodine + ammonia.

**Poisoning:** Have intense abdominal pain, muscular spasms, vomiting, purging, face livid, skin moist, black vomit containing coagulated mucus, coma, convulsions, paralysis, respiratory disturbance; when chronic have skin, conjunctivæ, and labial mucous membrane of a permanent slaty color, gastric ulceration. Administer weak draught of sodium chloride (to decompose the nitrate), egg-white, milk, tannin, followed by emetic, opium for pain, sodium hyposulphite baths, stimulants—alcohol, strychnine, atropine, etc.; *chronic silver-poisoning, argyria*, which gives slate-blue color to skin, livid cadaveric appearance, is usually not curable but palliated by potassium iodide.

**Incompatibles:** Alkalies, carbonates, chlorides, hydrochloric acid, tannin, potassium iodide, arsenic solution.

**Synergists:** Copper, lead, zinc.

**Argenti Oxidum.** Silver Oxide,  $\text{Ag}_2\text{O}$ .—(Syn., Oxidum Argentium, Argentum Oxydatum, Argentic Oxide; Fr. Oxide d'Argent; Ger. Silberoxyd.)

**Manufacture:** Shake silver nitrate solution with liquor potassii hydroxidi, wash precipitate— $2\text{AgNO}_3 + 2\text{KOH} = \text{Ag}_2\text{O} + 2\text{KNO}_3 + \text{H}_2\text{O}$ . It is a heavy brownish-black powder, decomposed by heat into metal and oxygen, insoluble in alcohol, partially so in water, soluble in nitric acid without effervescence, 0.5 Gm. fused should yield 0.464 Gm. of pure metallic silver; contains 99.8 p. c. of pure salt, corresponding to 92.9 p. c. of pure metallic silver. **Impurities:** Carbonate, chloride.

Should be kept in dark amber-colored bottles, and not brought in contact with ammonia, or triturated with readily oxidizable or combustible substances. Dose, gr.  $\frac{1}{4}$ –2 (.016–.13 Gm.), ter die, in pill; ointment (10–20 p. c.) useful externally.

**PROPERTIES AND USES.**—Similar to nitrate, but much weaker. Slight caustic, sedative; nausea, cardialgia, pyrosis, pains in the stomach, dysentery diarrhoea, night-sweats, dysmenorrhoea, menorrhagia, leucorrhoea, dilated uterus with flooding, tænia, venereal sores, gonorrhoea, hemorrhages, gastric ulcers, dyspepsia, catarrhal affections, colors skin somewhat.

**Incompatibles:** Chlorides, organic substances, creosote, etc.; these are oxidized, forming explosive compounds.

**Argenti Cyanidum.** Silver Cyanide, AgCN.—(Syn., Cyanuret of Silver, Argentum Cyanatum; Fr. Cyanure d'Argent; Ger Silbercyanid, Cyansilber.)

**Manufacture:** Distil potassium ferrocyanide, sulphuric acid, and water together, pass the evolved gas, HCN, into an aqueous solution of silver nitrate, wash, dry the precipitate— $\text{AgNO}_3 + \text{HCN} = \text{AgCN} + \text{HNO}_3$ ; or add solution of silver nitrate to solution of potassium cyanide until precipitation ceases, filter, wash well— $\text{AgNO}_3 + \text{KCN} = \text{AgCN} + \text{KNO}_3$ . It is a white powder, odorless, tasteless, permanent in dry air, brownish on exposure to light, insoluble in water, alcohol, cold nitric acid, soluble in boiling nitric acid ammonia water, sodium thiosulphate T. S. and potassium cyanide T. S., when fused gives off cyanogen gas, leaving residue of metallic silver (80.48 p. c.); contains 99.9 p. c. of pure salt, corresponding to 80.48 p. c. of original weight. Should be kept dark, in dark amber-colored bottles. Dose, gr.  $\frac{1}{80}$ – $\frac{1}{20}$  (.001–.003 Gm.).

**PREPARATION.**—1. *Acidum Hydrocyanicum Dilutum*—6 Gm. in 59.64 Cc.

The salt is rarely used in medicine, and is official solely for preparing this acid.

*Allied Salts:*

1. **Argenti Iodidum.** Silver Iodide, AgI.—Obtained by double decomposition between silver nitrate and potassium iodide, washing and drying the precipitate— $\text{AgNO}_3 + \text{KI} = \text{AgI} + \text{KNO}_3$ . It is a heavy, amorphous, yellow powder, unaltered by light; if impure becomes greenish-yellow, odorless, tasteless, insoluble in water, alcohol, diluted acids, soluble in solution of potassium cyanide. **Impurities:** Chloride, bromide. Should be kept in the dark, in amber-colored vials. Dose, gr.  $\frac{1}{4}$ –2 (.016–.13 Gm.), ter die, in pill. Similar to nitrate, and from its not coloring the skin, once was believed a better salt, but not now so considered; used in syphilis, visceral neuralgia, asthma, chorea, whooping-cough.

2. **Silver Vitellin.** *Argyrol.*—This is obtained by extracting and purifying one of the wheat proteids, gliadin (similar to vitellin), and heating it 3 hours under pressure in an autoclave with diluted hydro-

chloric acid ; to a concentrated solution of this salt add strong solution silver nitrate, dry precipitate in vacuo ; contains 30 p. c. of metallic silver ; occurs in black hygroscopic scales, soluble in water without deteriorating, coagulating albumin, or precipitating chlorides. Used locally in acute inflammations in 5–10–20–50 p. c. solutions—gonorrhœa (5 p. c.), chronic urethritis (5–10 p. c.), cystitis (10 p. c.), purulent conjunctivitis (25–50 p. c.), rhinitis, pharyngitis, laryngitis, vaginitis, dysentery ; internally, gastric ulcer, gastritis, gastro-enteritis. Dose, gr. 5–10 (.3–.6 Gm.).

### HYDRARGYRUM. MERCURY.

$\text{Hg}^{\text{II}} = 198.5.$

(Syn., Quicksilver, Hydrargyrum Vivum, Mercurius Vivus, Argentum Vivum ; Fr. Mercure, Vif Argent ; Ger. Quecksilber.)

The element mercury (after the messenger of the gods, from its mobility, quicksilver, similar origin ; L. *hydrargyrum* ; Gr. ὕδωρ, water, + ἀργυρος, whiteness, lustre) is found as globules in the metallic state and as mercuric sulphide, cinnabar, in mines of Spain, Austria, California, Peru, Japan, Mexico. The metal is obtained by roasting cinnabar in the air, which dissipates  $\text{SO}_2$ , and leaves Hg behind ; or may distil it with lime, which combines with the sulphur, and the mercury, being volatile, is conveyed into cooling chambers, where it condenses. It is a liquid metal, shining, silver-white, odorless, tasteless, sp. gr. 13.535, solidifies at  $-39.38^\circ \text{C}$ . ( $-38.88^\circ \text{F}$ .), boils at  $357^\circ \text{C}$ . ( $675^\circ \text{F}$ .), insoluble in ordinary solvents, HCl or cold  $\text{H}_2\text{SO}_4$ , soluble in  $\text{HNO}_3$  and with heat in  $\text{H}_2\text{SO}_4$  ; contains 99.9 p. c. of pure metal ; forms two series of compounds : 1, mercuric ( $\text{Hg}$ ) ; 2, mercurous ( $\text{Hg}_2$ ).

*Tests for Mercury Salts :* 1.  $\text{H}_2\text{S}$  or  $\text{NH}_4\text{SH}$  precipitates black mercuric (and mercurous) sulphide. 2. KI precipitates green mercurous iodide and red mercuric iodide, soluble in excess. 3. Potassium, sodium, or calcium hydroxide precipitates brownish-black mercurous oxide ( $\text{Hg}_2\text{O}$ ) and yellow mercuric oxide ( $\text{HgO}$ ). 4. Ammonium hydroxide precipitates black mercurous ammonium salt and white mercuric ammonium salt. 5. Metallic copper placed in acid mercuric solution soon becomes coated with metallic mercury.

**PREPARATIONS.**—1. *Emplastrum Hydrargyri*. Mercurial Plaster. (Syn., Emplastrum Mercuriale ; Fr. Emplâtre mercuriel ; Ger. Quecksilberpfaster.)

*Manufacture :* Triturate mercury 30 Gm. with oleate of mercury 1 Gm. until thoroughly divided, add hydrous wool-fat 10 Gm., continuing trituration until no mercury globules are visible, add this to melted lead plaster 59 Gm., or q. s. 100 Gm.

2. *Hydrargyrum cum Creta*. Mercury with Chalk. (Syn., Gray Powder, Æthiop's Cretaceus ; Fr. Mercure avec la Craie ; Poudre de Mercure crayeux ; Ger. Quecksilber mit Kreide.)

*Manufacture :* Shake mercury 38 Gm., clarified honey 10, water 2 Cc. in a bottle until globules disappear (10 hours), rub prepared chalk

57 Gm. with water q. s. for paste, to this add bottle contents, mix, dry to 100 Gm. It is a light gray, dampish powder, non-gritty, odorless, sweetish taste; warm acetic acid dissolves the chalk. *Impurities*: Mercurous and mercuric oxides, which make it more powerful. Should be kept dark, in well-stoppered bottles, owing to the ready oxidation of such finely divided mercury. Dose, gr. 5–10 (.3–.6 Gm.), twice daily; children, gr.  $\frac{1}{4}$ –3 (.01–.2 Gm.).

3. *Massa Hydrargyri*. Mass of Mercury. (Syn., Blue Mass, *Massa Cœrulea*, *Pilulæ Cœrulæ*; Br. *Pilula Hydrargyri*, Mercury Pill, Blue Pill; Fr. *Masse pilulaire bleue*, *Pilule de Mercure*; Ger. *Mercurial Pillen* (masse).)

*Manufacture*: 33 p. c. Triturate together mercury 33 Gm., honey of rose 33 Gm., until globules disappear, then add glycerin 9 Gm., and gradually glycyrrhiza 10 Gm., althæa 15 Gm., mix thoroughly. *Impurities*: Mercurous oxide (heat with acetic acid, add HCl, should get only slight opalescence), mercuric oxide (heat with diluted hydrochloric acid + little animal charcoal, filtrate should not be affected by hydrogen sulphide T. S., or stannous chloride T. S.). Dose, gr. 3–15 (.2–1 Gm.).

4. *Unguentum Hydrargyri*. Mercurial Ointment. (Syn., Blue Ointment, *Unguentum (Mercuriale) Neapolitanicum*; Br. Mercury Ointment; Fr. *Pomatum cum Hydrargyro*, Pommade (Onguent) *Mercurielle à parties égales*, Pommade napolitaine; Ger. *Unguentum Hydrargyri cinereum*, Graue Quecksilbersalbe.)

*Manufacture*: 50 p. c. Triturate mercury 50 Gm. with oleate of mercury 2 Gm. until globules disappear, then add benzoated lard 25 Gm., prepared suet 23 Gm., previously melted, mix thoroughly. *Assay*: Melt 10 Gm., add 50 Cc. warm petroleum benzin, decant latter after stirring, wash with petroleum benzin (10, +) until all fat removed, heat mercury in diluted hydrochloric acid until it collects in a globule, pour off acid, wash with distilled water, dry globule on bibulous paper; it should weigh 4.9 Gm.

Prep.: 1. *Unguentum Hydrargyri Dilutum*. Blue Ointment. (Syn., Fr. *Onguent mercuriel dilué*; Ger. *Verdünnte Graue Quecksilbersalbe*.)

*Manufacture*: Mix thoroughly mercurial ointment 67 Gm., petrolatum 33 Gm.

5. *Unguentum Hydrargyri Nitratis*. Ointment of Mercuric Nitrate. (Syn., *Unguentum (Hydrargyri) Citrinum*, Citrine Ointment; Fr. *Pomatum Citrinum*, Pommade Citrine, Onguent Citrin; Ger. *Quecksilbernitratsalbe*.)

*Manufacture*: Heat lard 76 Gm. to 105° C. (221° F.), withdraw heat, gradually add nitric acid 7 Gm., when reaction moderates heat until effervescence ceases, cool; dissolve mercury 7, in nitric acid 10.5, using some heat, add this to lard mixture; when beginning to congeal stir with wooden spatula until bright citrine color; avoid metallic utensils.

*Unoff. Preps.*: *Linimentum Hydragyri* (Br.), 66 p. c. *Unguentum Hydrargyri Compositum* (Br.), 40 p. c.

**PROPERTIES AND USES.**—Mercury—stimulant, alterative, tonic, antiphlogistic, sorbefacient, not directly a cholagogue, causes salivation; the liver retains it longest. Used in meningitis, bronchitis, pleuritis, pneumonitis, dysentery, rheumatism, hydrocephalus, ascites, hydrothorax, dropsy, intestinal obstruction, malarial enlargement of spleen, smallpox. Plaster—applied to syphilitic nodes, glandular engorgements, enlarged spleen, to cover face in smallpox. It not only gives support, but is also a counter-irritant, while the mercury is absorbed and exerts a constitutional effect. Mercury with Chalk—similar to blue mass, only much weaker. Give to children deficient in biliary secretion, indicated by clay-colored stools, bowel complaints, diarrhoea, alterative in constitutional syphilis; the chalk is antacid. Blue Mass—sialagogue, alterative, irritant, cathartic; for the first two give gr. 3 (.2 Gm.) nightly or on alternate nights, following in the morning with a laxative; for the last give gr. 5–15 (.3–1 Gm.), at night, and follow in the morning with a more active purgative; useful to increase liver and pancreas secretions. Mercurial and Blue Ointments—excellent externally, get resolvent effect by rubbing either upon the swollen or affected parts, and also a constitutional influence. Used in syphilis, when daily inunctions should be made under arms, flanks, thighs, chest, etc., swellings, glandular enlargements, engorged liver, spleen, inflamed joints, orchitis, smallpox eruption, erysipelas, prurigo pudendi, warts, and condylomata. Mercuric Nitrate Ointment—stimulant, alterative, similar to ointments of ammoniated mercury and red mercuric oxide, more stimulating than the former, often occasions salivation; eczema, tinea capitis, impetigo larvalis, psoriasis, pityriasis, psorophthalmia, and inflammation of eye, eyelids, etc.

**Hydrargyri Iodidum Flavum.** Yellow Mercurous Iodide, HgI.—(Syn., Hydrargyri Iodidum Viride, Protoiodide of Mercury, Yellow (Green) Iodide of Mercury, Hydrargyri Proto-ioduretum, Ioduretum Hydrargyrosum, Hydrargyrum Iodaturn, Hydrargyrum Iodaturn Flavum; Fr. Proto-iodure de Mercure, Iodure mercureux; Ger. Quecksilberjodür, Gelbes Jodquecksilber.)

**Manufacture:** Mix nitric acid and distilled water, each, 20 Cc., pour it upon mercury 50 Gm., when reaction ceases separate, drain and dry the crystals; dissolve 40 Gm. in distilled water 650 Cc. + nitric acid 6 Cc.; dissolve potassium iodide 16 Gm. in distilled water 32 Cc., and add this to mercurous nitrate solution with stirring, wash, dry precipitate—(1)  $6\text{Hg} + 8\text{HNO}_3 = 6\text{Hg}(\text{NO}_3)_2 + 4\text{H}_2\text{O}$ ; (2)  $2\text{Hg}(\text{NO}_3)_2 + 2\text{KI} = 2\text{HgI}_2 + 2\text{KNO}_3$ . It is a bright yellow, amorphous powder, odorless, tasteless, insoluble in alcohol, ether, nearly so in water, darkens on exposure, becoming metallic mercury and mercuric iodide; contains 99.5 p. c. of pure salt. **Impurities:** Mercuric iodide, etc. Should be kept dark, in dark amber-colored vials. Dose, gr.  $\frac{1}{4}$ –1 (.01–.06 Gm.), ter die, gradually increased until trebled, provided salivation or diarrhoea does not occur.

**PROPERTIES AND USES.**—In advanced constitutional syphilis, being by many considered the best salt for this disease.

**Hydrargyri Chloridum Corrosivum.** Corrosive Mercuric Chloride,  $\text{HgCl}_2$ .—(Syn., Corrosive Chloride (Bichloride) of Mercury, Corrosive Sublimate, Hydrargyrum (Muriaticum Corrosivum) Corrosivum Sublimatum, Mercurius Sublimatus Corrosivus, Chloruretum (Chloretum) Hydrargyricum; Br. Hydrargyri (Bichloridum) Perchloridum; Fr. Deuto-chlorure de Mercure, Chlorure mercurique; Ger. Hydrargyrum bichloratum, Quecksilberchlorid, Ätzensender Quecksilbersublimat.)

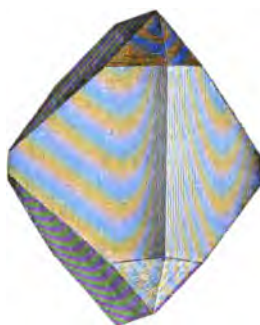
**Manufacture:** (1)  $\text{Hg} + 2\text{H}_2\text{SO}_4 = \text{HgSO}_4 + \text{SO}_2 + 2\text{H}_2\text{O}$ , evaporate to dryness. (2)  $\text{HgSO}_4$  (20 parts) +  $2\text{NaCl}$  (16 parts) =  $\text{HgCl}_2 + \text{Na}_2\text{SO}_4$ , by sublimation have this latter left behind, while the two volatile elements, Hg, Cl, pass off and condense in the cooler as mercuric chloride, or may heat mixture of mercuric sulphate, sodium chloride, and manganese dioxide— $\text{HgSO}_4 + 2\text{NaCl} + \text{MnO}_2 = \text{HgCl}_2 + \text{Na}_2\text{SO}_4 + \text{MnO}_2$ , when mercuric chloride sublimes over. The  $\text{MnO}_2$  is added to insure full liberation of chlorine, and thus prevent formation of mercurous chloride. It is in heavy, colorless, rhombic crystals or masses, odorless, with acrid, persistent metallic taste, permanent, soluble in 13 parts water, 3 alcohol, 2 boiling water, 14 glycerin, fuses at  $265^\circ \text{C}$ . ( $509^\circ \text{F}$ .), volatilizes in dense white vapors at  $300^\circ \text{C}$ . ( $572^\circ \text{F}$ .); contains 99.5 p. c. of pure salt. **Impurities:** Foreign metals and salts, arsenic. Should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{50}$ – $\frac{1}{8}$  (.0013–.008 Gm.), after meals, in bread pill; as antiseptic dressing the solution (1 gr. in 1,000–2,000) is valuable.

**Incompatibles:** Alkalies, their carbonates, potassium iodide, lime water, tartar emetic, lead acetate, silver nitrate, albumin, soap, tannin.

**PREPARATIONS.**—1. *Hydrargyrum Ammoniatum*. Ammoniated Mercury,  $\text{HgNH}_2\text{Cl}$ . (Syn., White Precipitate, Mercuric Ammonium Chloride, Hydrargyrum Ammoniato-muriaticum (Amidato-bichloratum), Hydrargyri Ammonio-chloridum, Mercurius Præcipitatus Albus, Mercur-ammonium Chloride; Fr. Chloramidure de Mercure, Oxychlorure Ammoniacal de Mercure, Lait Mercuriel, Mercure Précipité blanc; Ger. Hydrargyrum præcipitatum album, Weisser Quecksilberpräcipitat, Quecksilber Chloridamidid.)

**Manufacture:** Dissolve corrosive mercuric chloride 100 Gm. in warm distilled water 2,000 Cc., filter, cool, and pour gradually into ammonia water 150 Cc., constantly stirring, wash precipitate with distilled water 400 Cc., + ammonia water 20 Cc., then dry— $\text{HgCl}_2 + 2\text{NH}_4\text{OH} = \text{HgNH}_2\text{Cl} + \text{NH}_4\text{Cl} + 2\text{H}_2\text{O}$ . It is in white pulverulent pieces or white, amorphous powder, odorless, earthy, styptic, metallic

FIG. 458.



Corrosive mercuric chloride crystal.



taste, permanent. Prolonged washing converts it into basic salt; insoluble in water, alcohol, soluble in warm  $\text{HCl}$ ,  $\text{HNO}_3$ , or acetic acid, and cold solution of ammonium carbonate, or sodium thiosulphate; contains 78–80 p. c. of metallic mercury. *Impurities*: Foreign salts, metals, arsenic, mercurous salt, carbonate. Should be kept dark, in well-stoppered bottles.

Prep.: 1. *Unguentum Hydrargyri Ammoniatum*. Ointment of Ammoniated Mercury. (Syn., Ungentum Præcipitati Albi, Ointment of White Precipitate; Fr. Pommade de Précipité blanc; Ger. Unguentum Hydrargyri album, Weisse Quecksilbersalbe.)

*Manufacture*: 10 p. c. Rub ammoniated mercury 10 Gm. with 10 Gm. melted white petrolatum, add of the latter 40 Gm., then mix with hydrous wool-fat 40 Gm., stir until it congeals.

2. *Hydrargyri Iodidum Rubrum*. Red Mercuric Iodide,  $\text{HgI}_2$  (Syn., Biniodide of Mercury, Red Iodide of Mercury. Deuto-ioduretum (Biniodidum) Hydrargyri, Mercurius Iodatus Ruber, Ioduretum Hydrargyricum; Fr. Deuto-iodure (Bi-iodure) de Mercure, Iodure mercurique; Ger. Hydrargyrum bijodatum, Quecksilberjodid, Rother Jodquecksilber.)

*Manufacture*: Dissolve corrosive mercuric chloride 40 Gm. and potassium iodide 50 Gm., each, in distilled water 800 Cc., filter, pour both simultaneously, but slowly, into distilled water 2,000 Cc., constantly stirring, wash, dry precipitate— $\text{HgCl}_2 + 2\text{KI} = \text{HgI}_2 + 2\text{KCl}$ . It is a scarlet-red, amorphous powder, odorless, tasteless, permanent, nearly insoluble in water, soluble in 116 parts alcohol, 85 ether, 1,340 chloroform, solutions of soluble iodides ( $\text{KI}$ ,  $\text{HgCl}_2$ ), sodium thiosulphate; contains 99.5 p. c. of pure salt. *Impurities*: Mercuric chloride, soluble chlorides and iodides. Should be kept dark, in well-stoppered bottles. Dose, gr.  $\frac{1}{50}$ – $\frac{1}{8}$  (.0013–.008 Gm.).

Prep.: 1. *Liquor Arseni et Hydrargyri Iodidi*. Solution of Arsenous and Mercuric Iodide. (Syn., Donovan's Solution, Solution of Hydriodate of Arsenic and Mercury, Solutio Donovanii; Fr. Soluté d'Iodo-arsénite de Mercure, Liqueur de Donovan; Ger. Jodquecksilber-Arseniklösung, Donovanische Tropfen.)

*Manufacture*: Triturate together arsenous iodide 1 Gm. and red mercuric iodide 1 Gm., then add distilled water 15 Cc., when dissolved, filter and add distilled water q. s. 100 Cc. It is a clear, colorless or pale-yellowish aqueous liquid, odorless, disagreeable metallic taste; contains 1 p. c. of each, arsenous iodide, and mercuric iodide. Dose, Mij–5 (.2–.3 Cc.), ter die, diluted.

*Unoff. Prep.*: *Unguentum Hydrargyri Iodidi Rubri* (Br.), 4 p. c.

3. *Hydrargyri Oxidum Flavum*. Yellow Mercuric Oxide,  $\text{HgO}$ . (Syn., Hydrargyrum Oxidatum Flavum (Præcipitatum), Precipitated Oxide of Mercury or Mercuric Oxide; Fr. Oxyde mercurique jaune (précipité), Oxyde de Mercure jaune ou précipité, Deutoxyde jaune de Mercure; Ger. Hydrargyrum oxydatum via humida paratum, Gelbes Präcipitirtes) Quecksilberoxyd.)

**Manufacture:** Dissolve corrosive mercuric chloride 100 Gm. in warm distilled water 1,000 Cc., filter, also dissolve sodium hydroxide 40 Gm. in cold distilled water 1,000 Cc. and to this add first solution, constantly stirring, wash, dry precipitate— $\text{HgCl}_2 + 2\text{NaOH} = \text{HgO} + 2\text{NaCl} + \text{H}_2\text{O}$ . It is a light orange-yellow, amorphous, heavy, impalpable powder, odorless, metallic taste, permanent in air, darkens by light, nearly insoluble in water, alcohol, soluble in diluted HCl or  $\text{HNO}_3$ ; contains 99.5 p. c. of pure salt. **Impurities:** Foreign salts, metals, arsenic, red mercuric oxide, chlorides. Should be kept dark, in well-stoppered bottles.

**Preps.:** 1. *Unguentum Hydrargyri Ozidi Flavi*. Ointment of Yellow Mercuric Oxide. (Syn., Fr. Pommade d'Oxyde jaune de Mercure; Ger. Gelbe Quecksilberoxydsalbe.)

**Manufacture:** 10 p. c. Rub yellow mercuric oxide 10 Gm., with water 10 Gm. until mixture smooth, add hydrous wool-fat 40 Gm. in divided portions, incorporate with petrolatum 40 Gm.; avoid metallic utensils.

2. *Oleatum Hydrargyri*. Oleate of Mercury. (Syn., Hydrargyrum Oleicum—Oleīnicum—Elaīnicum; Br. Hydrargyri Oleas, Mercuric Oleat; Fr. Oléate mercurique (de Mercure); Ger. Oelsaures Quecksilber, Quecksilberoleat, Mercurioleat.)

**Manufacture:** 25 p. c. Triturate yellow mercuric oxide 25 Gm. with distilled water 25 Cc., add oleic acid 70 Gm., warm mortar, stir until water evaporated, add oleic acid q. s. 100 Gm.; avoid metallic utensils, preserve in tightly stoppered bottles. This may well be substituted for mercurial ointment, as it is absorbed more readily; for inflamed joints, indurations following abscesses, syphilis, tinea, psoriasis, eczema, hereditary syphilis.

**Preps.:** 1. *Emplastrum Hydrargyri*, 1 p. c. 2. *Unguentum Hydrargyri*, 2 p. c.

**Unoff. Preps.:** *Liquor Hydrargyri Perchloridi* (Br.), .08 p. c., dose, ʒss–j (2–4 Cc.). *Lotio Hydrargyri Flava* (Br.), 5 p. c. *Unguentum Hydrargyri Oleatis* (Br.), 25 p. c.

**PROPERTIES AND USES.**—Corrosive Sublimate—like many mercury compounds, is tonic, alterative, diuretic, antiseptic, disinfectant, irritant poison; seldom purges, and this can always be prevented by combining it with opium; large doses cause vomiting, griping pain in bowels, diarrhoea, small, irregular pulse; good in advanced syphilis, chronic skin affections and rheumatism, condylomata, engorged glands, diphtheria, pneumonia (injections). Externally—pseudomembranous laryngitis, fetid bronchitis, phthisis, skin diseases (psoriasis, acne, freckles, prurigo pudendi, pityriasis), ophthalmia, granular conjunctivitis, rhus-poisoning, malignant pustule, gonorrhoea, leucorrhoea, dysentery, cholera, hydrocele, wounds, ulcers, arthritis, parasites (pediculi pubis, etc.), vascular tumors. With lime water have yellow wash (*lotio flava*, *aqua phagedænica flava*),  $\frac{3}{10}$  p. c., used for ill-conditioned sores, ulcers, etc. Ammoniated Mercury—is a less active irritant than some other salts; it is poisonous, and owing to careless manufacture (per-

mitting exposure to light) often contains corrosive mercuric chloride; it is not given internally, and the ointment is of most service in ophthalmia and skin diseases. Red Iodide—is a powerful irritant poison; scrofula, constitutional syphilis, rheumatic pains. Externally—stimulant to indolent syphilitic and scrofulous ulcers, glandular swellings, lupus, goitre, enlarged spleen or liver, granular eyelids, bronchitis, disinfectant; may be applied in solution with potassium iodide (1 in 50), or ointment (1–4 in 20). Donovan's Solution—is given as an alterative in psoriasis, impetigo, porrigo, lepra, pityriasis, lupus, venereal eruptions, chronic rheumatism, night-pains. Yellow Oxide—externally as stimulant escharotic in powder or ointments; chancres, indolent ulcers, corneal ulcers.

*Poisoning:* Toxic doses of corrosive sublimate (red iodide, etc.) resemble those of arsenic in effect—have strong metallic taste, frequent bloody evacuations, tenesmus, feeling of constriction in throat, burning in œsophagus and stomach, swollen lips and tongue, quick, irregular pulse, cold extremities, intense abdominal pains, vomiting, labored respiration, suppressed urine, syncope, salivation, insensibility, convulsions, death. Give egg-white, beaten up with water (1 egg for every 4 grains), follow at once with emetic to remove, hence avoid re-solution of albuminous mercuric compound, demulcents, milk, flour-paste, meat-broth, opiates, potassium iodide, stimulants, heat.

**Hydrargyri Chloridum Mite. Mild Mercurous Chloride, HgCl.**—(Syn., Calomel, Mild Chloride (Subchloride) of Mercury, Hydrargyri Chloridum, Hydrargyrum Chloratum (Muriaticum) Dulce, Mercurius Dulcis, Calomelas, Chloruretum (Chloretum) Hydrargyrosomum; Br. Hydrargyri Subchloridum, Subchloride (Submuriate — Protochloride) of Mercury; Fr. Protochlorure (Sous-muriate) de Mercure, Mercure doux; Ger. Hydrargyrum chloratum (Mite), Quecksilberchlorür.)

*Manufacture:* Rub mercury (7) with mercuric sulphate (10) to form mercurous sulphate, sublime this with sodium chloride (5)—(1)  $\text{Hg} + 2\text{H}_2\text{SO}_4 = \text{HgSO}_4 + \text{SO}_2 + 2\text{H}_2\text{O}$ . (2)  $\text{HgSO}_4 + \text{Hg} = \text{Hg}_2\text{SO}_4$ . (3)  $\text{Hg}_2\text{SO}_4 + 2\text{NaCl} = 2\text{HgCl} + \text{Na}_2\text{SO}_4$  (this salt being left behind). It can be obtained in powder by rapidly condensing these vapors (Hg, Cl), when it is white, impalpable, becoming yellowish by continued trituration, odorless, tasteless, permanent, insoluble in water, alcohol, ether, volatile by heat; contains 99.5 p. c. of pure salt. *Impurities:* Foreign metals, salts, arsenic, soluble matter, mercuric chloride, ammoniated mercury. Should be kept in dark amber-colored bottles. Dose, gr. 1–15 (.06–1 Gm.); laxative gr. 2 (.13 Gm.), alterative gr. 1 (.06 Gm.). Children require more in proportion, thus two to three years old give gr. 2–3 (.13–.2 Gm.), and this dose often fails, when it should be followed by castor oil. Better results are obtained by giving small and often repeated doses, thus gr.  $\frac{1}{10}$  (.006 Gm.) hourly in tablet or powder with sugar or sodium bicarbonate (1 in 10) will usually act freely by time the tenth dose is taken.

PREPARATIONS.—1. *Pilulæ Catharticæ Compositæ*, 1 gr. (.06 Gm.). Dose, 1–3 pills.

*Unoff. Preps.*: *Unguentum Hydrargyri Subchloridi* (Br.), 10 p. c. *Lotio Hydrargyri Nigra* (Br.), .68 p. c.

PROPERTIES AND USES.—Purgative, anthelmintic, alterative, cholagogue. Most valuable mercury salt; lessens biliary secretion, causes salivation. Used for syphilis, typhoid, yellow and remittent fevers, inflammatory diseases, pericarditis, endocarditis, pleurisy, pneumonia, meningitis, hepatitis, dropsy, articular rheumatism, dysmenorrhœa, iritis, jaundice, pseudomembranous laryngitis, bronchitis, dysentery, cholera, lumbricoid worms. With lime water have black wash (*lotio nigra*, *aqua phagedænica nigra*),  $\frac{1}{4}$  p. c., used locally to syphilitic ulcers, etc. An ointment (10 p. c.) useful in scaly skin eruptions, condylomata, corneal ulcers, maggots.

**Hydrargyri Oxidum Rubrum.** Red Mercuric Oxide,  $\text{HgO}$ .—(Syn., Red Precipitate, Hydrargyri Nitrico-oxidum, Mercurius Corrosivus (Præcipitatus) Ruber, Peroxide of Mercury, Oxydum Hydrargyricum; Fr. Deut-oxyde (Peroxyde) rouge de Mercure, Oxyde mercurique, Précipité rouge, Poudre de Jean de Vigo; Ger. Hydrargyrum oxydatum rubrum, Rother Quecksilberoxyd, Rother Präcipitat (Quecksilber Präcipitat).)

*Manufacture*: Dissolve mercury in nitric acid, then either heat alone or triturate this dried mercuric nitrate with mercury and heat—(1)  $\text{Hg}_2 + 8\text{HNO}_3 = 3\text{Hg}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$ . (2)  $2\text{Hg}(\text{NO}_3)_2 + \text{heat} = 2\text{HgO} + 4\text{NO}_2 + \text{O}_2$ , or  $2\text{Hg}(\text{NO}_3)_2 + \text{Hg}_2 + \text{heat} = 4\text{HgO} + 2\text{N}_2\text{O}_4$ . It is in heavy orange-red crystalline scales or powder, becoming more yellow as its fineness increases, odorless, metallic taste, permanent, insoluble in alcohol, nearly so in water; soluble in diluted  $\text{HNO}_3$  or  $\text{HCl}$ ; at red heat decomposed into oxygen and metallic mercury; contains 99.5 p. c. of pure salt. *Impurities*: Yellow mercuric oxide, nitrate, chlorides, foreign salts, metals, arsenic. Should be kept in the dark, in well-stoppered bottles. Dose, gr.  $\frac{1}{10}$  (.006 Gm.), in syphilis.

PREPARATIONS.—1. *Unguentum Hydrargyri Oxidi Rubri*. Ointment of Red Mercuric Oxide. (Syn., Unguentum Præcipitatum Rubrum; Fr. Pommade de Précipité (d'Oxyde) rouge de Mercure, Pommade de Lyon, Baume ophthalmique rouge; Ger. Unguentum Hydrargyri rubrum, Rother Quecksilbersalbe.)

*Manufacture*: 10 p. c. Triturate red mercuric oxide 10 Gm. with water 10 Gm. until smooth, add hydrous wool-fat 40, in divided portions, incorporate this with petrolatum 40; avoid metallic utensils.

2. *Liquor Hydrargyri Nitratis*. Solution of Mercuric Nitrate. (Syn., Liquor Hydrargyri Nitrici Oxydati, Hydrargyrum Oxydatum Nitricum Solutum, Acid Solution of Nitrate of Mercury, Solution of Pernitrate of Mercury; Br. Liquor Hydrargyri Nitratis Acidus; Fr. Azotate (Nitrate) mercurique liquide, Nitrate Acide (Deutazotate—

Pernitrate) de Mercure (liquide); Ger. Flüssiges Salpetersaures Quecksilberoxyd, Mercurinitratlösung, Quecksilberoxydnitratlösung.)

*Manufacture:* Mix nitric acid 45 Gm. with distilled water 15 Gm., then in this dissolve red mercuric oxide 40 Gm. It is a nearly colorless, clear liquid containing 60 p. c. of mercuric nitrate,  $\text{Hg}(\text{NO}_3)_2$ , together with 11 p. c. of free  $\text{HNO}_3$ , heavy, nitric acid odor, sp. gr. 2.086, on evaporation get white residue, which heated gives yellow, red, brown, finally volatilizes. *Impurities:* Mercurous salt (nitrate), etc.

*Unoff. Prep.:* *Unguentum Hydrargyri Nitratis* (Br.), 37.5 p. c.

**PROPERTIES AND USES.**—Red Oxide—not used much internally, but mostly externally as stimulant, escharotic; ulcers, wounds, indolent syphilitic sores, condylomata, corneal opacity, granular eyelids, pannus, ozena in powder or ointment. The yellow oxide has nearly replaced this salt. Mercuric Cyanide—used instead of corrosive sublimate for constitutional syphilis, diphtheria (gargle 1 in 10,000). Liquor Hydrargyri Nitratis—used as a caustic for cancers, lupus, ulcerations of uterus, chancres, acne, boils, syphilitic sores, very poisonous, which may result even from skin absorption.

*Allied Salts:*

1. *Hydrargyri Subsulphas Flavus. Yellow Mercuric Subsulphate* (Turpeth Mineral),  $\text{Hg}(\text{HgO})_2\text{SO}_4$ .—Obtained by dissolving mercury 100 Gm. in sulphuric acid 30 Cc. + distilled water 15 Cc., adding gradually nitric acid 25 Cc. + distilled water 25 Cc., evaporating to dryness, powdering, and adding it gradually to boiling distilled water 2,000 Cc., boiling 10 minutes (to convert normal into basic sulphate, the acid sulphate remaining in solution), washing and drying precipitate— $\text{Hg}_3 + 3\text{H}_2\text{SO}_4 + 2\text{HNO}_3 = 3\text{HgSO}_4 + 2\text{NO} + 4\text{H}_2\text{O}$ . It is a heavy lemon-yellow powder, odorless, tasteless, permanent, soluble in  $\text{HNO}_3$ ,  $\text{HCl}$ , 2,000 parts water, 600 boiling water, insoluble in alcohol. *Impurities:* Mercurous salt, lead; should be kept in the dark, in well-stoppered bottles. Alternative, emetic, errhine, irritant poison, salivates; croup, spasmodic laryngitis. Dose, gr. 2–3 (.13–.2 Gm.), for child two years old, repeated in 15 minutes; as alternative for adult, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.016–.03 Gm.); emetic, gr. 2–5 (.13–.2 Gm.); errhine, gr. 1 (.06 Gm.) + starch q. s.; gr. 60 (4 Gm.) have killed.

FIG. 459.



Mercuric cyanide crystal.

2. *Hydrargyri Sulphidum Rubrum. Red Sulphide of Mercury, Cinnabar, HgS.*—Official 1880–1890. Obtained thus: Mercury 40 parts is added gradually to melted sublimed sulphur 8 parts, constantly stirring; the mass is heated until it begins swelling, then cooled under close cover, rubbed into powder, and sublimed. It is a mercuric salt, and occurs in brilliant dark red crystalline masses or bright scarlet powder, odorless, tasteless, permanent, insoluble in water, alcohol, nitric or hydrochloric acid, soluble in nitromuriatic acid, sp. gr. 8.12. *Impurities:* Arsenic, antimony,

chromates, iodides, sulphides, red oxide of mercury, red oxide of lead.

USES.—By fumigation as a sialagogue in syphilitic affections.

3. *Hydrargyri Cyanidum*. *Mercuric Cyanide*,  $\text{Hg}(\text{CN})_2$ .—Obtained by dissolving mercuric oxide in hydrocyanic acid, the latter being prepared from potassium ferrocyanide and sulphuric acid— $\text{HgO} + 2\text{HCN} = \text{Hg}(\text{CN})_2 + \text{H}_2\text{O}$ ; usually by passing HCN gas into mercuric oxide in water, when soluble  $\text{Hg}(\text{CN})_2$  is formed, evaporating to crystallize. It is in white prismatic crystals, odorless, bitter, metallic taste, darkens by light, exceedingly poisonous, soluble in 12.8 parts water, 12 alcohol. *Impurities*: Mercuric chloride, etc.; should be kept in well-stoppered bottles. Dose, gr.  $\frac{1}{16}$ — $\frac{1}{8}$  (.004–.008 Gm.).

## ARSENUM (ARSENICUM). ARSENIC.

$$\text{As}^{\text{III-V}} = 74.9.$$

(Official 1850–1880.)

The element arsenic (*L. arsenicum*, fr. Gr. *αρσενικόν*, orpiment; lit. masculine, strong—*i. e.*, powerful poison) is distributed widely, but generally in small quantities; occurs as native arsenic (cobaltum or fly-stone), as two sulphides (red orpiment or realgar,  $\text{As}_2\text{S}_2$ , and yellow orpiment,  $\text{As}_2\text{S}_3$ ), and as arsenides of various metals (arsenical pyrites or mispickel,  $\text{FeAsS}$ , cobalt glance,  $\text{CoS}_2\text{CoAs}_2$ , and tin-white cobalt,  $\text{CoAs}_2$ ). The metal may be obtained by heating arsenical pyrites— $\text{FeS}_2\text{FeAs}_2 + \text{heat} = 2\text{As} + 2\text{FeS}$ . Arsenic being volatile; passes over, condenses, and should be purified by heating with charcoal, as it may contain  $\text{As}_2\text{O}_3$ ; thus,  $\text{As}_2\text{O}_3 + 3\text{C} = 3\text{CO} + 2\text{As}$ . Metal is a steel-gray, metallic mass, losing lustre by forming a film of oxide, brittle, volatile, sp. gr. 5.73–5.88; used as a fly-poison and in shot (alloy of lead and arsenic). Forms two kinds of salts—*arsenous* (lower) and *arsenic* (higher).

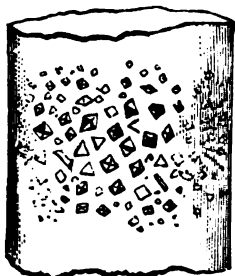
*Tests for Arsenic Salts*: 1.  $\text{H}_2\text{S}$  in acid solution precipitates bright yellow orpiment,  $\text{As}_2\text{S}_3$ , soluble in ammonia water. 2.  $\text{AgNO}_3$  with ammonia water precipitates in neutral solutions of arsenous acid yellow silver arsenite,  $\text{Ag}_3\text{AsO}_3$ , in arsenic acid solution get reddish-brown precipitate of silver arsenate,  $\text{Ag}_3\text{AsO}_4$ . 3. Cupric sulphate + arsenous acid + ammonia water precipitates Scheele's green—cupric arsenite,  $\text{CuHAsO}_3$ . 4. Marsh's test: Add to arsenic solution  $\text{Zn} + \text{H}_2\text{SO}_4$ , the escaping hydrogen gas when ignited deposits brown metallic ring upon cold porcelain, soluble in solution of chlorinated lime (bleaching-powder). 5. Reinsch's test: Add bright copper plate to acid arsenical solution, heat, when it becomes coated with film of metallic arsenic.

**Arseni Trioxidum.** **Arsenic Trioxide**,  $\text{As}_2\text{O}_3$ .—(Syn., Acidum Arsenosum, U. S. P. 1890, Arsenic, White Arsenic, Flowers of Arsenic, Arsenicum Album; Br. Arsenious Anhydride; Fr. Acide arsénieux,

Arsenic blanc, Fleurs d'Arsenic; Ger. Acidum arsenicosum, Arsenige Säure, Weisser Arsenik.)

*Manufacture*: This is often a by-product in separating metal from the ores (cobalt, nickel, tin, silver, arsenical iron pyrites) metallurgically, when by roasting it sublimes; it becomes acid only in the presence of water— $2\text{As}_2\text{O}_3 + 6\text{H}_2\text{O} = 4\text{H}_3\text{AsO}_3$ . It is a heavy solid—either an opaque, white powder, or irregular masses of two varieties: one amorphous, transparent, colorless like glass; the other crystalline, opaque, white, resembling porcelain; often same piece has opaque, white outer crust

FIG. 460.



Sublimate arsenic trioxide, magnified.

enclosing the glassy variety, the latter being converted into the former when exposed to moist air; both odorless, tasteless, slowly soluble in water, the glassy in 30 parts, the porcelain-like or crystalline powder in 100, twice as soluble in boiling water, 5 glycerin, sublimes without residue; contains 99.8 p. c. of pure salt. *Assay*: Dissolve 0.1 Gm. + 1 Gm. sodium bicarbonate in 20 Cc. water + heat; this should decolorize 20.3 Cc.  $\frac{N}{10}$  iodine V. S. (corresponding to 99.8 p. c. of arsenic trioxide). *Impurities*: Arsenic acid, antimony, tin, cadmium, arsenous sulphide, non-volatile matter.

PREPARATIONS.—1. *Liquor Acidi Arsenosi*.

Solution of Arsenous Acid. (Syn., Solution of Arsenic Chloride, Hydrochloric Solution of Arsenic; Br. Liquor Arsenici (Chloridi) Hydrochloricus; Fr. Liqueur arsénicale hydrochlorique; Ger. Chlorarseniklösung.)

*Manufacture*: 1 p. c. Mix diluted hydrochloric acid 5 Gm. with distilled water 25 Cc., add arsenic trioxide 1 Gm., boil until dissolved, add distilled water q. s. 100 Gm., filter. It is a clear, colorless, aqueous liquid, odorless, acidulous taste, acid reaction; contains arsenous acid corresponding to 1 p. c. of arsenic trioxide. *Assay*: 24.6 Gm. — sodium bicarbonate 2 Gm., + water 100 Cc., should require 50 Cc.  $\frac{N}{10}$  iodine V. S. to produce permanent yellow tint (corresponding to 1 Gm. of arsenic trioxide in 100 Gm. of the solution). Dose,  $\mathfrak{Mij}$ –5 (.2–.3 Cc.), ter die, diluted.

2. *Liquor Potassii Arsenitis*. Solution of Potassium Arsenite. (Syn., Fowler's Solution, Arsenical Solution, Solutio Arsenicalis Fowleri, Kali Arsenicosum Solutum; Br. Liquor Arsenicalis; Fr. Liqueur (Solution) arsenicale de Fowler; Ger. Liquor Kalii arsenicosi, Fowlersche Lösung (Tropfen).)

*Manufacture*: 1 p. c. Boil arsenic trioxide 1 Gm. and potassium bicarbonate 2, with distilled water 10 Cc., until dissolved, add distilled water q. s. 97 Gm., + compound tincture of lavender 3; this aqueous solution contains potassium arsenite corresponding to 1 p. c. of arsenic trioxide. *Assay*: 24.6 Gm. + 100 Cc. water, slightly acidified with diluted hydrochloric acid, + sodium bicarbonate 2 Gm., should require 50 Cc.  $\frac{N}{10}$  iodine V. S. to produce permanent yellow tint (corresponding

to 1 Gm. arsenic trioxide in 100 Gm. of solution). Dose, Mijj-5 (.2-3 Cc.), ter die, diluted.

3. *Arseni Iodidum*. Arsenous Iodide,  $\text{AsI}_3$ . (Syn., Arsenici Iodidum, Ioduretum Arseniosum; Fr. Iodure d'Arsecic; Ger. Arsenicum (Arsenum) jodatum, Arsenik Jodur, Arsentrijodid.)

*Manufacture*: 1.  $\text{As}_2\text{O}_3 + 6\text{HCl}$  (hot) =  $2\text{AsCl}_3 + 3\text{H}_2\text{O}$ , which by double decomposition with KI gives  $\text{AsI}_3$ ; thus,  $2\text{AsCl}_3 + 6\text{KI} = 2\text{AsI}_3 + 6\text{KCl}$ . 2.  $\text{As}_2\text{O}_3 + 6\text{HI} = 2\text{AsI}_3 + 3\text{H}_2\text{O}$ . 3. Triturate and heat together metallic arsenic 75 parts and iodine 380. It is an orange-red, inodorous, crystalline powder, stable when kept cool and dark, soluble with partial decomposition in 12 parts water, 28 alcohol, readily in chloroform, carbon disulphide, ether, loses no iodine when heated on water-bath, beyond that volatilizes, warmed with nitric acid get brown nitrous oxide vapors followed by those of iodine (violet); contains 82.7 p. c. of iodine, and 16.3 p. c. of metallic arsenic. *Assay*: Dissolve 0.5 Gm. + 2 Gm. sodium bicarbonate in 50 Cc. water; this should require 21.9 Cc.  $\frac{\text{N}}{10}$  iodine V. S. to give solution a slight yellow tint. Should be kept cool, dark, in glass-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{20}$ — $\frac{1}{10}$  (.003-.006 Gm.).

Prep.: 1. *Liquor Arseni et Hydrargyri Iodidi*, 1 p. c.

**PROPERTIES AND USES.**—Arsenic Trioxide—alterative, anaphrodisiac, irritant poison, nervine, tonic; chronic malaria, intermittents, skin diseases (eczema, psoriasis, lepra, prurigo), nervous debility, chorea, chronic rheumatism, gout, constitutional syphilis, frontal neuralgia, hemicrania, obesity, gastralgia, anæmia, spasmodic asthma, amenorrhœa, dysmenorrhœa, menorrhagia, leucorrhœa, diabetes, albuminuria, chronic diarrhœa. Externally—cancers, lupus, epithelial tumors, sarcoma, warts, malignant ulcers, carious teeth. The two liquors are good forms for administration, but it may also be given in tablet, pill, etc. Arsenic Iodide—alterative, irritant poison, used like the acid, but mostly in pill form, and never should be applied on abraded surfaces; Donovan's solution and the ointment ( $\frac{1}{2}$ –1 p. c.) have merited popularity.

*Poisoning*: All arsenic compounds produce symptoms resembling those of cholera: constriction and heat of fauces, faintness, nausea, burning abdominal pain and tenderness, thirst, violent retching, vomiting (brown often streaked with blood), bloody stools, tenesmus, strangury, cold skin, small and feeble pulse, spasms, dyspnœa, death in collapse. Wash out stomach, give emetics, follow with recently prepared ferric hydroxide or ferric hydroxide with magnesium oxide, dialyzed iron, to envelop, as well as to form insoluble ferric arsenite or arsenate, chalk, lime water, demulcents, opiates, stimulants, heat, spirit nitrous ether, remove iron compound with zinc sulphate.

*Incompatibles*: Salts of iron, silver, copper, ammonium, calcium, magnesium oxide, vegetable astringents.

*Synergists*: Restoratives, nux vomica, etc.



## ANTIMONIUM. ANTIMONY (STIBIUM).

 $\text{Sb}^{\text{III-V}} = 119.3.$ 

(Official 1830–1840.)

The element antimony (Gr. *ἀντί*, against, + *moine*, monk—monk's-bane, poisons monks; or Gr. *ἀντί*, against, + *μόνος*, alone—never found alone; or Gr. *ἀντί*, instead of, + L. *minium*, red lead—women once used it instead of red lead for painting around the eyes; L. *stibium*, Gr. *στιβί*, name of sulphide of antimony) has several official compounds, and occurs natively uncombined, also as oxide, oxysulphide, and mostly as sulphide. From this latter the metal is obtained by roasting it into an oxide, then reducing that with charcoal. It is brittle, bluish-white like silver, crystalline structure, sp. gr. 6.7; forms *antimonous* and *antimonic* compounds.

*Tests for Antimony Salts*: 1.  $\text{H}_2\text{S}$  in acid solution precipitates orange-red antimonous or antimonic sulphide,  $\text{Sb}_2\text{S}_3$  or  $\text{Sb}_2\text{S}_5$ , soluble in ammonia water. 2. The sulphide dissolved in  $\text{HCl}$  and thrown into water precipitates white oxychloride. 3. Zinc and iron precipitate antimony as black powder from its solutions, while copper precipitates it as a black metallic film upon itself, which when heated volatilizes the antimony, depositing it as antimonous oxide. 4. Marsh's test; here brown rings are produced on porcelain, as in arsenic, which are insoluble in solution of chlorinated lime (bleaching-powder).

**Antimonii et Potassii Tartras.** Antimony and Potassium Tartrate,  $2\text{K}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6 + \text{H}_2\text{O}$ .—(Syn., Tartar Emetic, Tartarated Antimony; Antimonium Tartarisatum, Tartarus Emeticus, Stibio-kali Tartaricum; Br. Antimonium Tartaratum, Tartarated Antimony; Fr. Tartrate d'Antimoine et de Potasse, Emétique, Tartre stibié; Ger. Tartarus stibiatus, Brechweinstein.)

*Manufacture*: Antimony oxide 150 Gm. + potassium bitartrate 180 Gm. + water 1,000 Cc., boil together one hour, let crystallize— $2\text{KHC}_4\text{H}_4\text{O}_6 + \text{Sb}_2\text{O}_3 = 2\text{K}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$ . It is in colorless, transparent crystals, becoming opaque by exposure, white or in white granular powder, odorless, sweet disagreeable metallic taste, soluble in 15.5 parts water, 3 boiling water, insoluble in alcohol, which precipitates it from aqueous solution, heated to  $110^\circ \text{C}$ . ( $230^\circ \text{F}$ .) loses water of crystallization (2.71 p. c.); contains 99.5 p. c. of pure salt. *Assay*: 1 Gm. dissolved in water q. s. 100 Cc.; of this 33 Cc. + 20 Cc. cold saturated aqueous solution sodium bicarbonate, + little starch T. S., should require 19.9 Cc. iodine V. S. to produce permanent blue color (each Cc. corresponding to 5 p. c. of pure salt). *Impurities*: Heavy metals (iron, etc.), arsenic, calcium, chloride, sulphate, potassium bitartrate. Dose, alterative, gr.  $\frac{1}{32}$ – $\frac{1}{16}$  (.002–.004 Gm.); diaphoretic, expectorant, gr.  $\frac{1}{12}$ – $\frac{1}{8}$  (.005–.01 Gm.); nauseating sudorific, gr.  $\frac{1}{4}$ – $\frac{1}{2}$  (.01–.016 Gm.), every few hours; emetic, gr.  $\frac{1}{2}$  (.03 Gm.), repeated every 20 minutes with warm water or chamomile tea until vomiting occurs.

**PREPARATIONS.**—1. *Vinum Antimonii*. Wine of Antimony. (Syn., *Vinum Emeticum*; Br. *Vinum Antimoniale*, Antimonial Wine; Fr. *Vin (antimonié—émétique) stibié*; Ger. *Vinum stibiatum*, Brechwein.)

*Manufacture*: Dissolve antimony and potassium tartrate 4 Gm. in boiling distilled water 6.5 Cc., and add this to alcohol 17.5 Cc., white wine 72.5, previously mixed, when cool add white wine q. s. 100 Cc. Dose,  $\mathfrak{M}\times$ —30 (.6–2 Cc.), repeated as desired; as emetic for children, 3ss–1 (2–4 Cc.), repeated every 15 minutes until vomiting occurs.

Prep.: 1. *Mistura Glycyrrhizæ Composita*, 6 p. c.

2. *Syrupus Scillæ Compositus*,  $\frac{1}{5}$  p. c.

**PROPERTIES AND USES.**—Sedative, diaphoretic, expectorant, antiphlogistic, emetic, febrile complaints, first stage of bronchitis, pneumonia, pleurisy, acute rheumatism, tonsillitis, mammary abscess, hernia humoralis, ophthalmia, mumps, skin affections (eczema, urticaria, psoriasis), dropsy, salivation, meningitis, epilepsy, chorea, mania, convulsions, mania-a-potu, rigid os uteri, strangulated hernia, dislocations, nævi, varicose veins. Externally—applied in strong solution or ointment causes pustular eruptions like those of smallpox, producing scabs and indelible scars. Antimony Wine—a good form for diaphoresis in fever crisis, febrifuge, expectorant.

*Poisoning*: Symptoms similar to arsenic, but less marked; have metallic taste, abdominal pain, incessant retching, præcordial cramps, burning heat, distended epigastrium, colic, frequent watery stools, dry throat, salivation, difficult deglutition, skin cool, clammy, muscles relaxed, pulse feeble, thready, respiration slow, scanty bloody urine, death may be preceded by stupor, mild delirium, or convulsions. Place in horizontal position, lower head, wash out stomach with solution of tannic acid, green tea, or galls, then demulcent drinks, egg-white, milk, warmth, friction, electricity, opium, stimulants; tartar emetic gr. 2–5 (.13–.3 Gm.) have killed.

*Incompatibles*: Opium, alcohol, cardiac stimulants, antispasmodics, tannin, gallic acid, lead salts.

*Synergists*: Emetics, cathartics, cardiac depressants.

*Allied Salts*:

1. *Antimonii Sulphidum*. *Antimony Sulphide*,  $\text{Sb}_2\text{S}_3$ .—Official 1820–1900. This is native antimony sulphide purified by fusion and as free from arsenic as possible; the grayish-black ore, stibnite (Europe, United States), containing galena, iron pyrites, quartz, and heavy spar, is heated in pots, whereby fusible antimony sulphide runs off into earthen vessels to cool. It is in steel-gray masses, metallic lustre, striated, crystalline fracture, forming grayish-black lustreless powder, odorless, tasteless, permanent, soluble in HCl, insoluble in water, alcohol. Dose, freely in veterinary practice.

2. *Antimonii Sulphidum Purificatum*. *Purified Antimony Sulphide*,  $\text{Sb}_2\text{S}_3$ .—Official 1820–1900. Obtained by taking finely powdered antimony sulphide 100 Gm., removing coarser particles by elutriation, and macerating for 5 days the fine subsiding sulphide in ammonia water 50 Cc., agitating frequently to remove any arsenic present, then washing

with water and drying. It is a heavy, blackish, lustreless powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in HCl with evolution of hydrogen sulphide. *Impurities*: Arsenic, etc. Used only for pharmaceutical purposes, not prescribed internally to any extent. Dose, gr. 10–30 (.6–2 Gm.), in powder or bolus.

3. *Antimonium Sulphuratum*. *Sulphurated Antimony, Kermes Mineral*.—Official 1820–1900. Obtained by boiling 2 hours purified antimony sulphide 100 Gm., solution sodium hydroxide 1,200 Cc., distilled water 3,000 Cc., frequently stirring, and adding water to preserve volume, strain, drop into it, while hot, diluted sulphuric acid q. s. to precipitate completely, wash precipitate with hot distilled water, dry, reduce to powder. It is an amorphous, reddish-brown powder, odorless, tasteless, losing color on exposure. *Impurities*: Calcium, chloride, sulphate. Alterative, diaphoretic, emetic, but an uncertain medicine. Dose, alterative, gr. 1–2 (.06–.13 Gm.), twice daily, in pill; emetic, gr. 5–20 (.3–1.3 Gm.). Plummer's Pills (*Pilulae Antimonii Compositae*, U. S. P. 1890),  $\frac{3}{4}$  gr. (.036 Gm.), used in secondary syphilis, skin eruptions, and while taking should avoid acids. Dose, 1–3 pills.

4. *Antimonii Oxidum*. *Antimony Oxide, Sb<sub>2</sub>O<sub>3</sub>*.—Official 1820–1900. Obtained by pouring a solution of antimony chloride into water, thus precipitating the oxychloride, which is to be decomposed by sodium carbonate. It is a heavy, grayish-white powder, odorless, tasteless, permanent, nearly insoluble in water, alcohol, ether, nitric acid, soluble in hydrochloric acid, warm solutions of tartaric acid or potassium bitartrate. *Impurities*: Iron, copper, lead, arsenic, chloride, sulphate. Seldom used in medicine, although possessing antimonial properties; owing to its limited solubility does not nauseate or vomit very much; constitutes 33 p. c. of James' Powder (*Pulvis Antimonialis*, U. S. P. 1890), used as a diaphoretic in febrile conditions. Dose, gr. 2–4 (.13–.26 Gm.).

## STANNUM. TIN.

$$\text{Sn}^{\text{II-IV}} = 118.8.$$

(Official 1830–1860.)

The element tin (AS. *tin*, *stean*, *stan*, a stone; L. *stannum*, found at Cornwall as oxide, tin-stone) occurs chiefly as native stannic oxide (tin-stone), SnO<sub>2</sub>. The metal is obtained by heating this oxide with carbon—SnO<sub>2</sub> + 2C = Sn + 2CO. It is a nearly silver-white metal, very malleable, fusing at 228° C. (440° F.); forms two series of compounds, *stannous* and *stannic*.

*Tests for Tin Salts*: 1. With H<sub>2</sub>S in stannous solution get brown stannous sulphide. 2. With H<sub>2</sub>S in stannic solution get yellow stannic sulphide, both precipitates being soluble in ammonium sulphide.

Tin is used in alloys, with mercury to silver mirrors, and to coat sheet iron to yield tin plate. The stannous chloride, SnCl<sub>2</sub>, is a strong deoxidizing agent used to precipitate the metals mercury and gold, and as a mordant in calico-printing.

## AURUM. GOLD.

Au<sup>1-III</sup> = 196.7.

(Official 1830–1840.)

The element gold (AS. *geolu*, *giolo*, yellow; Gr. *χλωρός*; L. *aurum*, yellowish—*i. e.*, color of the metal) usually occurs in the metallic state with other metals, but sometimes as sulphide. It is separated from adhering rock, sand, etc., by washing, its greater specific gravity (19.3) causing it to subside. When pure it is quite soft, so that for general use it is alloyed with harder metals. Jewelers recognize the pure metal as 24 carat (seldom employed), and when mixed with 25 p. c. of copper or silver as 18 carat. It is affected by none of the pure acids, being dissolved only by nitrohydrochloric acid, free chlorine or bromine, and mercury, forming with this latter an amalgam.

*Tests for Gold Salts:* 1. H<sub>2</sub>S precipitates brown auric sulphide, Au<sub>2</sub>S<sub>3</sub>, soluble in ammonium sulphide. 2. FeSO<sub>4</sub> added and set aside soon precipitates metallic gold in dark powder, which by fusion is converted into a metallic button. 3. Stannous chloride precipitates purple (of Cassius).

**Auri et Sodii Chloridum.** Gold and Sodium Chloride.—(Syn., Chloruretum Aurico-sodicum; Fr. Chloraurate de Sodium, Chlorure d'Or et de Sodium; Ger. Auro-natrium Chloratum, Natriumgold-chlorid.)

*Manufacture:* Gold 13 parts, dissolve in a mixture of nitric (16 parts) and hydrochloric (48 parts) acids, add water q. s. 40 parts. To this add dry sodium chloride 20 parts, evaporate to dryness with stirring. (1)  $\text{Au}_2 + 2\text{HNO}_3 + 8\text{HCl} = 2\text{HAuCl}_4$  or  $2(\text{AuCl}_3 + \text{HCl}) + 2\text{NO} + 4\text{H}_2\text{O}$ . (2)  $\text{HAuCl}_4 + \text{NaCl} = \text{NaAuCl}_4$  or  $(\text{AuCl}_3 + \text{NaCl}) + \text{HCl}$ . It is a mixture of equal weights of anhydrous gold chloride, AuCl<sub>3</sub>, and anhydrous sodium chloride, NaCl, representing at least 30 p. c. of metallic gold; it is an orange-yellow powder, saline metallic taste, deliquescent in damp air, soluble in water, one-half in alcohol, reduced to metallic gold by red heat. *Assay:* 0.5 Gm. dissolved in 25 Cc. water, + 5 Cc. potassium hydroxide T. S., + 5 Cc. solution hydrogen dioxide, heated 1 hour, should give precipitate of metallic gold, which washed with acidified (HCl) water, dried, ignited, should weigh 0.15 Gm. (corresponding to 30 p. c. of metallic gold). *Impurities:* Free hydrochloric acid, metallic substances. Should be kept in well-stoppered, amber-colored bottles. Dose, gr.  $\frac{1}{20}$ – $\frac{1}{4}$  (.003–.016 Gm.); supposed to be the basis of the "Keeley cure," along with hypodermics of atropine, strychnine, etc.

**PROPERTIES AND USES.**—Action similar to that of mercury, used for syphilis, scrofula, sclerosis of the spine, liver, and kidneys, hypochondriasis, asthma, dysmenorrhœa, migraine, epilepsy, chorea, hysteria, consumption, habitual inebriety. Externally—caustic, like AgNO<sub>3</sub>, for lupoid, cancerous, and other ulcers. In addition to the double

chloride, the bromide, iodide, and oxide also are used in doses of  $\frac{1}{20}$ – $\frac{1}{4}$  (.003–.016 Gm.), after meals; also the powdered metal may be given in doses gr.  $\frac{1}{8}$ –1 (.01–.06 Gm.).

## PLATINUM.

$\text{Pt}^{\text{II-IV}} = 194.3.$

The element platinum (Sp. *platina*, dim. of *plata*, plate, silver—the two metals resemble in appearance), like gold, occurs mostly in the free state and in combination with iridium, osmium, palladium, rhodium, ruthenium, etc., metals resembling it; also in ores containing gold, lead, iron, silver; comes mainly from Ural Mountains and California. It is silvery white, soft like copper, malleable, ductile, possesses high fusing-point and great resistance to chemicals, soluble in nitrohydrochloric or nitrohydrobromic acid, good conductor of heat and electricity, sp. gr. 21.5; forms two series of compounds—*platinous*,  $\text{PtCl}_2$ , and *platinic*,  $\text{PtCl}_4$ .

**Platini Chloridum.** Platinic Chloride,  $\text{PtCl}_4 \cdot 5\text{H}_2\text{O}$ .—(Syn., Fr. Perchlorure de Platine; Ger. Platinchlorid.)

*Manufacture:* Platinum 3 parts + hydrochloric acid 16 + nitric acid 7, evaporate nearly to dryness, redissolve in  $\text{HCl}$ , heat to expel  $\text{HNO}_3$ , evaporate to dryness; contains 46 p. c. of platinum.

*PREPARATION.*—*Platinic Chloride Test Solution:* Chloroplatinic acid,  $\text{H}_2\text{PtCl}_6 \cdot 6\text{H}_2\text{O}$ , 2.6 Gm. dissolved in 20 Cc. distilled water.

**PROPERTIES AND USES.**—Seldom used in medicine, although the chloride has been employed with good results in constitutional syphilis in doses gr.  $\frac{1}{8}$ – $\frac{1}{2}$  (.008–.03 Gm.); the injection (1 p. c.) has been effective in leucorrhœa, gleet, indolent ulcers.

## PART IV.

### ORGANIC CARBON COMPOUNDS.

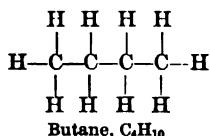
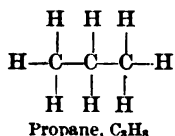
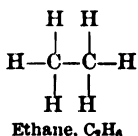
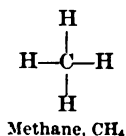
WHILE the number of official preparations made from organic substances is small at present compared with the many that have gained medical favor, and while those accepted by the *Pharmacopœia* are most important and universally employed, yet it has been deemed wise to include here additionally a few that are scarcely secondary, and which may have a future recognition. So many, built artificially and synthetically, are but reproductions in strength, effect, medicinal properties, etc., of natural plant-products, that we may reasonably expect a time when many such will, to a great extent, replace those from all other sources. As materia medica products are either inorganic or organic, and as the former comprise two great series: metals and metalloids, so the latter has two distinctive series: fatty and aromatic, consequently in this relationship-sequence they will be considered.

For a long time the term organic medicines was applied only to those agents taken directly from plants or animals—from a source built up of manifold varying organs in which alone was supposed to reside “vital force,” by which all substances only could be created. We no longer hold tacitly to such restriction, because these very substances often are reproduced by a direct combination of the component elements or from apparent inorganic material which once was organic in nature.

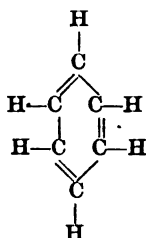
Organic carbon compounds must contain, however, carbon and hydrogen, also frequently oxygen, nitrogen, sulphur. Such elements so differ from each other in chemical and physical properties, while their combining quantities are so unrestricted, that they unite in varying proportions to yield many hundred substances, each differing somewhat from the other.

Carbon is quadrivalent, and it is considered the graphical centre around which the other elements are to be arranged, being linked as it were by a bond dependent, as to strength and degree, upon each element's atomic valence. The grouping of these carbon atoms in a molecule is quite different in the two organic series.

I. FATTY SERIES: Derivatives of methane,  $\text{CH}_4$ , and are linked so as to form an open chain in which the end carbon atoms are not equivalent to the others:



II. AROMATIC SERIES: Derivatives of benzene (benzol),  $C_6H_6$ , and are linked to form a close chain in which every carbon atom is the equivalent of each other. This chain (skeleton) has been assumed from the fact that as soon as 6 or more carbon atoms come together they tend so to unite as to form stable and permanent compounds into which only definite amounts of other elements can be introduced.



Benzene,  $C_6H_6$

Thus benzene takes up 2-4-6 atoms of hydrogen, chlorine, bromine, and under the prolonged action of HI becomes  $C_6H_{12}$ , and no more H can be imparted even if the action be continued indefinitely, whereas if carbon atoms were in open chain we would get  $C_6H_{14}$ , etc. Then, again, when the hexa-chloride or bromide of benzene is formed, each refuses to take up any more of either element, thus showing roundness or entireness in saturation and composition.

## I. FATTY SERIES.

### I. Hydrocarbons.

These compounds contain the elements carbon and hydrogen in various proportions, are mostly of vegetable origin, many being obtained by destructive distillation and decomposition of organic matter, and all have different boiling-points, by which it is possible to isolate them when carefully distilled fractionally. They are either gases, liquids, or solids, according to the number of carbon atoms in the molecule: 1-4 = gas, 4-10-12 = liquid, and beyond this = solid; they can all be volatilized without decomposition, are colorless, usually with characteristic odor, neutral, soluble in alcohol, ether, carbon disulphide, insoluble in water, oxidize by exposure the liquids often becoming solids.

**Benzinum.** Petroleum Benzin,  $C_5H_{12} + C_6H_{14} +$ .—(Syn., Petroleum Ether, Benzine; Fr. Esprit (Naphthé, Éther) de Pétrole, Pétroléine; Ger. Benzinum Petrolei, Petroleumbenzin, Petroläther.)

*Manufacture:* Benzin (*benz(oic) + in*—odor somewhat benzoin-like) is a purified distillate from American petroleum, consisting of hydrocarbons, chiefly of marsh-gas series and homologous compounds ( $C_5H_{12}$ ,  $C_6H_{14}$ , etc.). It results upon subjecting crude petroleum to a refining process by fractional distillation, when benzin or naphtha, illuminating oils, and a residuum largely composed of paraffin are obtained—that part collected at 45-60° C. (113-140° F.) being the official product;

further purification may be effected by treating with sulphuric acid, then alkalis and distilling. It is a transparent, colorless, diffusible liquid, strong characteristic odor of petroleum, but less disagreeable, neutral, sp. gr. 0.650, boils at 45–60° C. (113–140° F.), soluble in ether, chloroform, benzene, volatile oils, fixed oils except castor oil, 6 parts alcohol, insoluble in water, highly inflammable, vapors explosive. *Impurities*: Benzene, etc. Should be kept cool, remote from lights or fire, in well-stoppered bottles or tin cans.

**PREPARATION.**—1. *Benzinum Purificatum*. Purified Petroleum Benzin. (Syn., Fr. Ether de Pétrole purifié; Ger. Gereinigter Petroläther.)

*Manufacture*: Add sulphuric acid 6 Cc. to water 55 Cc., when cold add potassium permanganate .8 Gm., agitate, when dissolved add petroleum benzin 100 Cc. in four portions, shaking after each, let stand 24 hours, shaking frequently, decant petroleum benzin, add thereto potassium permanganate .2 Gm., dissolved in water 24 Cc. in which sodium hydroxide .2 Gm. has previously been dissolved, agitate frequently, repeat washing with water and decant purified petroleum benzin. *Impurities*: Heavy hydrocarbons, pyrogenous products, sulphur compounds—which the process is intended to remove. It should have an ethereal or faint petroleum-like odor; should be kept with same precautions, and respond to tests of petroleum benzin. Dose, ℥x–20 (.6–1.3 Cc.), emulsion, capsule, on sugar.

**PROPERTIES AND USES.**—Internally—vermifuge; Externally—sedative, anæsthetic, solvent, tape-worm, scabies, prurigo, herpes, favus, sycosis, rheumatism, neuralgia, to relieve itching in urticaria, whooping-cough. Like creosote and phenol (carbolic acid) to restrain fermentation in dyspepsia. Good solvent for fats, volatile oils, resins, caoutchouc, alkaloids, etc.

**Petrolatum Liquidum. Liquid Petrolatum.**—(Syn., Paraffinum Liquidum, Liquid Paraffin; Fr. Huile de Paraffine; Ger. Flüssiges Paraffin, Paraffinöl.)

*Manufacture*: Liquid petrolatum (*L. petra*; Gr. πέτρα, rock, + *L. oleum*; Gr. έλαιον, oil—rock oil) is a mixture of the hydrocarbons, chiefly of the methane series, obtained by distilling off most of the lighter and more volatile portions from petroleum (a substance found in wells, on surface of streams, and oozing from the ground in Pennsylvania, New York, Ohio, etc.), and purifying the liquid residue; the portion going over at 330–390° C. (626–734° F.) is treated with sulphuric acid, then with caustic alkali, filtered while hot through animal charcoal, cooled to remove solid paraffins, which crystallize out; now collect and reserve that fraction distilling at above 360° C. (626° F.). It is a colorless or yellowish, oily, transparent liquid, odorless—when heated, faint petroleum odor—tasteless, sp. gr. 0.870–0.940, soluble in ether, chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene, fixed and volatile oils; insoluble in water, alcohol. *Impurities*: Fixed oils or fats of animal or vegetable origin, rosin, organic matter.

**PREPARATION.**—1. *Ceratum Cantharidis*, 15 p. c.



**Petrolatum.** *Petrolatum*,  $C_{16}H_{34}$  +.—(Syn., *Petrolatum Molle*, *Petrolatum Spissum*, U. S. P. 1890; Fr. *Pétroléine*; Ger. *Unguentum Paraffinum*, *Paraffin*-(salbe) butter.)

*Manufacture*: A mixture of hydrocarbons, chiefly of the methane series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue. It is an unctuous mass, consistence of ointment, yellowish to light amber, possessing fluorescence, even when melted, transparent in thin layers, amorphous, odorless, tasteless, when heated giving off faint petroleum-like odor; liquefied at  $60^{\circ}$  C. ( $140^{\circ}$  F.) has sp. gr. 0.840; melts at  $45$ – $48^{\circ}$  C. ( $113$ – $118^{\circ}$  F.), otherwise similar to liquid petrolatum.

**PREPARATIONS.**—1. *Emplastrum Adhæsivum*, 2 p. c. 2. *Unguentum Hydrargyri Dulutum*, 33 p. c. 3. *Unguentum Hydrargyri Oxidi Flavi*, 40 p. c. 4. *Unguentum Hydrargyri Oxidi Rubri*, 40 p. c.

**Petrolatum Album.** *White Petrolatum.*—(Syn. *Paraffinum Album*, *White Paraffin*, *Refined Petrolatum* (*Paraffin*).)

*Manufacture*: A colorless mixture of hydrocarbons, chiefly of the methane series, obtained by distilling off the lighter and more volatile portions from petroleum and purifying the residue. It is a white unctuous mass, consistence of ointment, transparent in thin layers, amorphous, odorless, tasteless, otherwise similar to petrolatum.

**PREPARATIONS.**—1. *Ceratum*, 20 p. c. 2. *Ceratum Camphoræ*, 15 p. c. 3. *Ceratum Plumbi Subacetatis*, 38 p. c. 4. *Unguentum Acidi Borici*, 80 p. c. 5. *Unguentum Hydrargyri Ammoniati*, 50 p. c. 6. *Unguentum Phenolis*, 97 p. c. 7. *Unguentum Zinci Stearatis*, 50 p. c.

**PROPERTIES AND USES.**—Petrolatum in its three forms is a bland, neutral, protective dressing and a substitute for fatty substances in ointments; large doses, mild laxative, soothing internal irritation and inflammation. Liquid form largely used in spray, being a good vehicle and solvent for many medicinal agents, applicable to mucous membranes of bronchi, larynx, nose, throat; also used for lubricating purposes. None becomes rancid, and all are absolutely non-irritating. Workmen employed in its manufacture never are troubled with chronic bronchitis or phthisis.

*Allied Products:*

1. *Bitumen.* *Bitumen.*—Official 1820–1830. This was the crude petroleum (L. *petra*, rock, + *oleum*) as found in various places (North America, England, Scotland, West Indies) under the names naphtha, petroleum, oleum gabearium, Seneca oil, Barbadoes tar (naphtha), Trinidad pitch, etc. Formerly was used as we now use petroleum; upon distillation have residue left in still, termed solid bitumen or asphaltum.

2. *Rhigolene.*—Obtained from petroleum by redistillation until a liquid is secured boiling at  $18^{\circ}$  C. ( $64.4^{\circ}$  F.). It evaporates more rapidly than all known liquids (except cymogene, which boils at  $0^{\circ}$  C. ( $32^{\circ}$  F.)), and when atomized gives a temperature of  $-9^{\circ}$  C. ( $15.8^{\circ}$  F.). Used to produce local numbness, or freezing, for minor operations by cautery, etc.

**Paraffinum. Paraffin.**—(Syn., Br. Paraffinum Durum, Hard. Paraffin; Fr. Paraffine; Ger. Paraffinum Solidum, Festes Paraffin, Ceresin, Gereinigtes Erdwachs.)

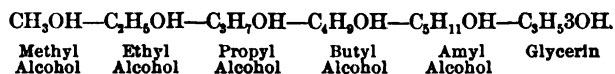
**Manufacture:** This is a mixture of solid hydrocarbons, chiefly of the methane series, usually obtained by chilling and pressing the distillates from petroleum having high boiling-points, and purifying the solid press cake so obtained. Paraffins are formed from fats and other organic compounds, but chiefly result from destructive distillation of bituminous shale, etc., found as natural constituent in petroleum, and in minerals known as mineral wax, earth-wax, and ozokerite. The tarry oil of shale is distilled, giving a residue of coke and asphalt, treat distillate with sulphuric acid, then with sodium hydroxide (to remove olefins, phenols), wash product, redistil, and after recovery of lighter hydrocarbons and lubricating oils, the remaining thick oil upon cooling separates paraffin; dissolve crude paraffin in petroleum or naphtha, again separate by refrigeration and pressure, melt, decolorize by filtering through animal charcoal. It is a colorless, somewhat translucent, mass, crystalline when separating from solution, slightly greasy to touch, odorless, tasteless, soluble in ether, petroleum benzin, benzene, carbon disulphide, volatile oils, warm fixed oils, insoluble in water, alcohol, melts at 52–57° C. (125–135° F.), increased burns with luminous flame depositing carbon, no residue; contains chiefly  $C_{24}H_{50}$  and  $C_{27}H_{56}$ . **Tests:** 1. 0.5 Gm. heated with 0.5 Gm. sulphur becomes black from separated carbon, evolving hydrogen sulphide. 2. 0.5 Gm. heated, + fuchsin 0.1 Gm. to fused mass, should not assume pink or red color (abs. of stearic acid).

**PREPARATIONS.**—1. *Ceratum Plumbi Subacetatis*, 20 p. c. 2. *Unguentum Acidi Borici*, 10 p. c.

**PROPERTIES AND USES.**—Protective, emollient; preserves lemons, meat, etc., when coated with thin film, makes paper impervious to moisture, lubricator, chewing gum, to adulterate candies, chocolate, coat pills, bottles, jars, boxes, to correct deformities, inject into tissues, ointments, candles.

## II. Alcohols.

These are hydrocarbon residues in combination with hydroxyl, OH, or hydrocarbons in which one or more hydrogen atoms have been replaced by hydroxyl, if 1 = monatomic, 2 = diatomic, 3 = triatomic, 4 = tetratomic alcohols, etc. They are hydroxides of the organic radicals or residues, as thus shown:



Here methane,  $\text{CH}_4$ , is converted into methyl,  $\text{CH}_3$ , which combines with hydroxyl, OH, to form methyl alcohol. Ethane,  $\text{C}_2\text{H}_6$ , is converted into ethyl,  $\text{C}_2\text{H}_5$ , which unites with OH to form ethyl alcohol, etc.

## 1. MONOTOMIC ALCOHOLS.

**Alcohol.** Alcohol,  $C_2H_5OH$ .—(Syn., Alcohol Vini, Spirit of Wine, Common (Ethyl) Alcohol, Spiritus Vini Rectificatissimus; Br. Spiritus Rectificatus, Rectified Spirit; Fr. Alcool, Esprit de Vin; Ger. Spiritus, (Rectificirter) Weingeist.) A liquid composed of 92.3 p. c. by weight, or 94.9 p. c. by volume, of ethyl alcohol,  $C_2H_5OH$ , and 7.7 p. c. by weight of water.

**Manufacture:** 1. From ethene,  $C_2H_4$ , by adding the elements of water, which can be done by shaking with sulphuric acid—(1)  $C_2H_4 + H_2SO_4 = C_2H_5HSO_4$ . (2)  $C_2H_5HSO_4 + H_2O + \text{distillation} = C_2H_5OH + H_2SO_4$ . 2. Obtained on a large scale by the mashing process—fermenting (with yeast, etc.) certain weak saccharine solutions containing grape-sugar or glucose— $C_6H_{12}O_6 + \text{ferment} = 2C_2H_5OH + 2CO_2$ . In actual practice, grain, such as barley, corn, rye, wheat, is malted or germinated. Here the starch is acted on by the contained ferment (diastase), converting it into maltodextrin and maltose, and finally into dextrose, apparently by the simple appropriation of water— $3C_6H_{10}O_5$  (starch) +  $H_2O = C_6H_{10}O_5$  (dextrin) +  $C_{12}H_{22}O_{11}$  (maltose);  $C_6H_{10}O_5 + C_{12}H_{22}O_{11} + H_2O = 3C_6H_{12}O_6$  (dextrose). This will be transformed into other products if germination be allowed to go on, but prior to that resulting (when acrospire is about one-third the length of the grain, and maximum amount of diastase is present), the sprouted grain is roasted, ground, then infused in warm water, thus forming *mash*, and the yielded dextrose solution, *wort*, fermented by yeast. This fermented liquid, *wash*, contains water, fusel oil, glycerin, succinic acid, and never more than 14 p. c. alcohol, as the yeast plant is unable to live in a fluid of greater strength. By first distillation get *low wine* (about 20 p. c. alcohol), and by second distillation a liquid much richer in alcohol—*raw whisky*, which treated with charcoal, redistilled and vapors passed through a series of condensers gives a product free from water and other impurities—the final traces of these being removed by redistillation over sodium manganate, anhydrous sodium acetate (2 p. c. for odor), and freshly burned lime. Alcohol is a transparent, colorless, mobile, volatile liquid, agreeable odor, characteristic burning taste, sp. gr. 0.816, boils at  $78^\circ C.$  ( $172.4^\circ F.$ ), miscible with water, chloroform, ether, inflammable, burns with blue flame. **Impurities:** Fusel oil, aldehyde (acetic acid), methyl alcohol, oak-tannin, amyl alcohol, non-volatile, carbonizable organic impurities. Should be kept cool, remote from lights or fire, in well-closed vessels.

**PREPARATIONS.**—1. *Alcohol Dilutum.* Diluted Alcohol. (Syn., Proof Spirit; Fr. Alcool dilué; Ger. Spiritus Dilutus (Vini Rectificatus), Verdünnter Weingeist.) A liquid composed of 41.5 p. c. by weight, or 48.9 p. c. by volume, of absolute ethyl alcohol,  $C_2H_5OH$ , and 58.5 p. c. of water.

**Manufacture:** 1. Alcohol 50 Cc., distilled water 50 Cc., when mixed and cooled will measure 97 Cc. 2. Alcohol 40.8 Gm., distilled water 50 Gm. It has sp. gr. 0.936; should respond to alcohol tests, and be kept cool, remote from lights or fire, in well-closed vessels.

2. *Alcohol Absolutum*. Absolute Alcohol. (Syn., Alcohol Ethylicum; Fr. Alcool Absolu; Ger. Alcohol absolutus, Absoluter Alkohol.) Ethyl alcohol containing not more than 1 p. c. by weight of water.

*Manufacture*: Percolate the strongest and purest alcohol through recently burned lime, out of contact with air, redistil the percolate in vacuo. It is very hygroscopic, sp. gr. 0.795. Should have same characteristics and be kept under same conditions as preceding.

*Spiritus Frumenti*. Whisky.—(Syn., Fr. Eau de Vie de Grains; Ger. Kornbranntwein.)

*Manufacture*: An alcoholic liquid obtained by distilling the mash of fermented grain—such as Indian corn, rye, wheat and barley, or their mixtures, sometimes oats and potatoes. The infusion is fermented as for alcohol, by which the saccharine matter and indirectly starch are converted into alcohol and CO<sub>2</sub>; this resulting liquid from the mash is distilled, yielding low wines, which are in turn distilled, giving a stronger and purer spirit with less fusel oil, known as raw corn-spirit or whisky. This is kept in barrels for several years, at least four, to mellow and improve in flavor by formation of compound ethers, then colored, diluted if necessary, and placed upon the market. It is an amber-colored liquid, distinctive odor and taste, sp. gr. 0.924–0.945, corresponding to alcoholic strength 44–50 p. c. by weight, or 50–58 p. c. by volume. *Impurities*: Fusel oil from grain, added sugar, glycerin, aromatic substances, oak-tannin from casks, free acid.

*Spiritus Vini Gallici*. Brandy.—(Syn., Spirit of French Wine; Fr. Eau de Vie, Cognac; Ger. Spiritus e Vino, Weinbranntwein, Spiritus vini Cognac, Franzbranntwein, Branntwein.)

*Manufacture*: An alcoholic liquid obtained by distilling the fermented, unmodified juice of fresh grapes, and at least 4 years old. When the pure juices of fruits are fermented and the resulting liquid from the *marc* distilled, the distillate is brandy; hence we may have a number of brandies named according to the fruit used, as grape, apple, peach, etc. It is that of grapes, however, which is official and recognized throughout the world under the name of brandy. The best is from the grape wines of France, produced in the districts of Cognac, Armagnac, Bordeaux, Rochelle, etc. Most excellent brands are distilled also in Spain, Portugal, Germany, and United States—Catawba and California being considered our best. Brandy is a pale, amber-colored liquid, distinctive odor and taste, sp. gr. 0.925–0.941, corresponding to an alcoholic strength of 39–47 p. c. by weight, or 46–55 p. c. by volume. *Impurities*: Fusel oil from grain or potato spirit, added sugar, glycerin, aromatic substances, oak-tannin from casks, free acid.

PREPARATION.—(Unoff.) *Mistura Spiritus Vini Gallici* (Br.), 42 p. c., dose, ʒj–2 (30–60 Cc.).

*Allied Products*:

1. *Vinum Album*. White Wine. See page 405.
2. *Vinum Rubrum*. Red Wine. See page 405.

3. *Vinum Xericum*. *Sherry Wine*.—Official 1850–1880. This was formerly the representative selected to be used whenever white wine was desired; sp. gr. 0.978–0.995; alcoholic strength 18–22 p. c.

4. *Vinum Portense*. *Port Wine*.—Official 1850–1880. This was formerly the representative selected to be used whenever red wine was desired. It is from the grape cultivated near the river Douro, in Portugal, being exported from Oporto; alcoholic strength 18–22 p. c.

PROPERTIES AND USES.—Alcohol in its various forms is stimulant, depressant, diuretic, astringent, disinfectant, antipyretic, rubefacient, diaphoretic; stimulates heart muscle, causing rapid and strong beats, dilates peripheral bloodvessels, stimulates brain by increasing blood supply; before meals improves appetite, during meals retards digestion by checking flow of gastric juice and increasing secretion of mucus, moderate amounts serve as a food, being oxidized during circulation; lessens waste of tissues. It is rapidly absorbed and eliminated by kidneys, lungs, skin, and liver. Internally—debility, typhoid and other low fevers, pyæmia, pneumonia, erysipelas, after shock, fatigue, prolonged sickness, syncope, delirium, febrile stupor, tremor, eruptive and relapsing fevers, consumption, delirium tremens, poisoning by serpents, narcotics, etc., tetanus, epilepsy, reflex convulsions (as in dentition), vomiting of pregnancy, neuralgia. Externally—wounds, abscesses, aneurisms, gangrenous and other ulcers, nipple fissures, sore feet, bruises, sprains, paralyzed limbs, nasal polypi, soft tumors, varicocele. As an anæsthetic to diminish shock of surgical operation, to facilitate reduction of dislocation.

Alcohol—in pharmacy is quite indispensable by reason of its extractive and preservative powers; also useful to preserve animal tissue, and in the arts.

Whisky—is an excellent stimulant, does not constipate like brandy, and owing to its cheapness and purity is preferred generally. Used also as an antiseptic in wounds, ulcers, etc. Brandy—on the other hand, is more grateful to the stomach, more palatable, and less apt than whisky, gin, etc., to cause liver or kidney diseases. It is much used in low fevers, with milk, flavored to the patient's taste.

*Poisoning*: Have confused mind, giddiness, muscular relaxation, hallucinations, stupor, coma, rapid, weak pulse, cool, moist skin, dilated pupils, noisy breathing, livid lips; can usually arouse for a short time. Continued abuse may produce chronic gastritis, liver cirrhosis, gout, peripheral neuritis, delirium tremens, mania, Bright's disease, predisposes to phthisis, and lessens resistance to pneumonia and surgical operations. When acute, empty stomach by mustard, hypodermic apomorphine, or pump, washing it out well with strong warm coffee, plenty fresh air, inhale ammonia, give aromatic spirit of ammonia, coffee, capsicum, vinegar, hot milk, apply cold water to head, warmth to body and extremities, electricity. In delirium may quiet with hydrated chloral, potassium bromide, opium, follow with digitalis, strychnine, possibly gastric sedatives (bismuth subnitrate, phenol (carbolic acid), etc.).

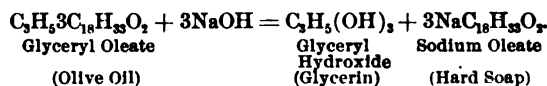
*Allied Product:*

1. *Alcohol Amylicum, Amyl (Amylic) Alcohol*,  $C_5H_{11}OH$ .—(Syn., Pentyl Alcohol, Fusel Oil, Hydrated Oxide of Amyl, Grain Oil, Potato Spirit Oil; Fr. Huile de Grain.) Official 1860–1880. During the alcoholic fermentation of grain, and especially potatoes, amyl alcohol is produced, the great bulk of which passes over with the last portions of the first distillation, which are milky and contain additionally varying amounts of ethyl (20–30 p. c.), propyl and isobutyl alcohols, water, pyridin, furfurol, ethers, etc., differing with the fusel oil source. To purify wash with strong solution sodium chloride or calcium chloride, distil washed residuum, collecting that coming over at 128–131° C. (262–268° F.). It is an oily colorless liquid, penetrating oppressive odor, burning acrid taste, sp. gr. 0.818, boils at 132° C. (269° F.), congeals at –134° C. (–209° F.), soluble in alcohol, insoluble in water. Does not take fire like alcohol, requiring heating to 55° C. (131° F.) before igniting. When treated with an oxidizing agent 2 atoms of H are replaced by 1 of O, giving  $C_5H_{10}O_2$ , which is amylic or valeric (valerianic) acid, this being the method of obtaining nearly all of this acid. It is poisonous, and should be given cautiously as a nervous stimulant, in phthisis; chiefly used to make amyl nitrite, fruit-essences (ether), sodium valerate, and valeric acid.

## 2. TRIATOMIC ALCOHOLS.

**Glycerinum.** *Glycerin, Glycerol*,  $C_3H_5(OH)_3$ .—(Syn., Glycerine, Glycerina; Fr. Glycérine; Ger. Glycerolxyhydrate, Oelsüss, Scheelesches Süss.)

*Manufacture:* Glycerin (Gr. γλυκερός, γλυκύς, sweet—its taste) exists in combination with the fatty acids, forming compound ethers (= fats: animal, vegetable, liquid, and solid), and when these are acted upon (decomposed) by an alkali we have glycerin liberated, while the alkali unites with the fat acids, forming soluble soap:



It is a clear, colorless liquid containing not less than 95 p. c. of absolute glycerin,  $C_3H_5(OH)_3$ , thick syrupy consistence, smooth to touch, odorless, sweet, warm taste, hygroscopic, sp. gr. 1.250, soluble in water, alcohol; insoluble in ether, chloroform, carbon disulphide, petroleum benzin, benzene, fixed and volatile oils, boils at 165° C. (329° F.), and finally is decomposed and dissipated, vaporizes from aqueous solution at 100° C. (212° F.); contains 95 p. c. of absolute glycerol. *Impurities:* Heavy metals, arsenic, calcium salts, butyric, oxalic, sulphuric acids, acrolein, sugars, readily carbonizable substances, water, mucilage, dextrin, glucose, cane-sugar, syrup. Dose, ℥x–60 (.6–4 Cc.).

*PREPARATION.*—1. *Suppositoria Glycerini.* Suppositories of Glycer-

erin. (Syn., Br. Glycerin Suppositories; Fr. Suppositoires de Glycerin; Ger. Glycerin Suppositorien (Stuhlzäpfchen).)

*Manufacture:* Dissolve monohydrated sodium carbonate 30 Gm. in water 5 Cc., add glycerin 30 Gm., stearic acid 2 Gm., heat until all carbon dioxide has escaped, pour into 10 moulds, cool. Should be kept in tightly stoppered glass vessels.

**PROPERTIES AND USES.**—Irritant, laxative, solvent, emollient when diluted. Externally—skin diseases (eczema, herpes, lepra, pityriasis, psoriasis, lichen, prurigo); in lotion for incrustated lupus, chapped skin, excoriating surfaces, fissures of anus and nipple, wounds, boils, carbuncles, abscesses, coryza, pharyngitis, otorrhœa; allays itching, dryness of mouth, deafness. Internally—phthisis, diabetes, typhoid fever, constipation, in enemas or suppositories, ascariæ, dysentery, hemorrhoids, leucorrhœa. In pharmacy as a solvent (iodine, bromine, tannin, alkaloids, salicin, alkalies, etc.), vehicle, excipient, preservative, to keep extracts soft and from moulding, etc. Suppositories—for constipation, acting as mechanical irritants; 1 applied night and morning.

**Spiritus Glycerylis Nitratis.** Spirit of Glyceryl Trinitrate, Spirit of Nitroglycerin.—(Syn., Spiritus Glonoini. U. S. P. 1890, Spirit of Glonoin; Br. Liquor Trinitrini, Solution of Trinitrin (Nitroglycerin); Propenyl Trinitrate).

*Manufacture:* Gradually add dehydrated glycerin 7 parts to well-cooled solution sodium nitrate 20, in sulphuric acid 40, or add slowly glycerin 1, to 7 of mixture composed of nitric acid 1 + sulphuric acid 2, keeping below 27° C. (80° F.), the radical NO<sub>2</sub> replacing hydrogen in the glycerin— $C_3H_5(OH)_3 + 3HNO_3 = C_3H_5(NO_2)_3 + 3H_2O$ ; in either case the glyceryl trinitrate separates as an oily layer, which is washed with water and dilute sodium hydroxide solution to remove acid. It is an alcoholic solution containing 1 p. c., by weight, of glyceryl trinitrate,  $C_3H_5(NO_2)_3$ ; it is clear, colorless, odor and taste of alcohol, sp. gr. 0.826–0.832. Should be kept cool, remote from lights or fire, transported in well-stoppered tin cans, dispensed and handled with great care, as dangerous explosions may result when spilled and alcohol evaporated—should such occur pour over it at once solution potassium hydroxide to decompose it. Dose, Mj–3 (.06–.2 Cc.).

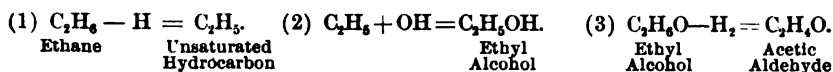
**PREPARATION.**—(Unoff.) *Tabellæ Trinitrini* (Br.), each contains trinitroglycerin,  $\frac{1}{100}$  gr. (.0006 Gm.).

**PROPERTIES AND USES.**—Like amyl nitrite (or any nitrite), except that its action is not quite so prompt, but is more persistent. Angina pectoris, asthma, convulsions, tetanus, collapse, illuminating-gas, strychnine- and chloroform-poisoning, cardiac stimulant. If taken early, often wards off attacks of cardiac pain and epileptic seizures. It is thought that in undergoing alkaline decomposition in the system the nitrite is formed, which yields nascent nitrous acid. May be given by mouth or hypodermically; very little often produces headache when tasted or applied to the skin.

## III. Aldehydes.

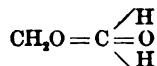
## 1. HALOGEN DERIVATIVES.

Aldehydes are obtained from alcohol by removing 2 atoms of hydrogen, hence name *al*(cohol) + *dehyd*(rogenatus)—*de*, from, + hydrogen—i. e., alcohol deprived of hydrogen. They are chemically between alcohols and acids, and may be considered unsaturated hydrocarbons attached to COH, thus :



The hydrogen may be removed by oxidation, when 1 atom of outside oxygen combines with 2 atoms of alcoholic hydrogen, forming 1 molecule of water and the aldehyde, which by further oxidation forms its corresponding acid.

**Liquor Formaldehydi.** **Solution of Formaldehyde.**—(Syn., Formalin, Formal, Formol; Fr. Soluté d'Aldéhyde de formique; Ger. Formaldehydum Solutum, Formaldehydlösung.) An aqueous solution containing 37 p. c., by weight, of absolute formaldehyde,  $\text{CH}_2\text{O}$ , an oxidation product of methyl alcohol.



**Manufacture:** The heated vapors of methyl alcohol mixed with air are passed over glowing coke, or copper spirals; or pass methane (marsh gas) over heated mixture of copper, pumice and asbestos fibres, and the resulting products of oxidation into water, removing any undecomposed methyl alcohol by subsequent distillation, and adjusting proper strength by dilution or concentration. It is a clear, colorless liquid, pungent odor, caustic taste, vapor an irritant upon mucous membrane, sp. gr. 1.075, miscible with water, alcohol, sometimes cloudy from separation of paraformaldehyde (age), evaporated over sulphuric acid or in vacuum have rapidly formed solid paraformaldehyde, heated above  $100^\circ \text{C}$ . ( $212^\circ \text{F}$ .) sublimes, at  $153\text{--}172^\circ \text{C}$ . ( $307\text{--}342^\circ \text{F}$ .) melts, evolving gaseous formaldehyde. **Tests:** 1. Dilute 5 Cc. with 25 Cc. distilled water, + 3 Cc. silver ammonium nitrate T. S., get gray precipitate of finely divided metallic silver, often adhering as a mirror. 2. Add 2 drops to sulphuric acid 5 Cc. + little salicylic acid, get permanent deep-red color. **Assay:** Weigh 3 Gm. in Erlenmeyer flask, add 50 Cc. normal sodium hydroxide V. S., then slowly 50 Cc. hydrogen dioxide solution containing 1 drop litmus T. S. and neutralized with normal sodium hydroxide V. S., after reaction ceases titrate back with normal sulphuric acid V. S. + litmus T. S. indicator; subtract number Cc. of normal sulphuric acid V. S. consumed from 50, multiply remainder by 2.979, divide product by weight taken (3), quotient = p. c., by weight, of absolute formaldehyde present. **Impurities:** Iron, lead,



copper, calcium, chloride, sulphate, fixed substances, formic and other acids.

**PROPERTIES AND USES.**—Antiseptic, disinfectant, germicide, irritant, preservative; about equal to corrosive mercuric chloride in power. A room containing 500 cubic feet can be disinfected by 1 pint (0.5 L.) when converted into vapor, within an hour, or 2 pints (1 L.) will suffice for an ordinary-sized room. Has been largely but unlawfully employed for preserving milk, food, beer, wine, etc.; used also intravenously for combating septicæmia; diluted with 2–10 parts water claimed to retard growth of uterine cancer.

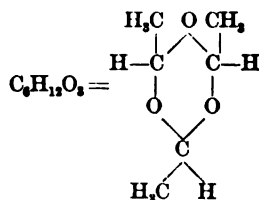
**Paraform** (Paraformaldehyde, Triformol),  $(\text{CH}_2\text{O})_3$ . This is a polymeric form obtained by evaporating formaldehyde solution, and occurs as a white crystalline powder, insoluble in water. Disinfectant by heating, usually the compressed tablets; antiseptic internally and externally. Dose, gr. 5–15 (.3–1 Gm.).

**Hexamethylenamina.** Hexamethylenamine,  $\text{C}_6\text{H}_{12}\text{N}_4$ .—(Syn. Urotropinum, Urotropine, Hexamethylene-tetramine, Uritone, Formin. Aminoform.) A condensation product obtained by action of ammonia upon formaldehyde.

**Manufacture:** Add to 100 parts 40 p. c. solution formaldehyde, kept well cooled, 80 parts stronger ammonia water, in successive quantities, set aside 12–24 hours to crystallize. It is in colorless, odorless, lustrous rhombic crystals, soluble in 1.5 parts water, 10 alcohol, 228 ether, sublimes at  $263^\circ\text{C}$ . ( $505^\circ\text{F}$ .) without melting. **Tests:** 1. 0.1 Gm. + 0.1 Gm. salicylic acid + 5 Cc. sulphuric acid, + moderate heat gives carmine-red color. 2. Aqueous solution (1 in 10) heated with diluted sulphuric acid is decomposed, liberating formaldehyde (recognized by odor). 3. Aqueous solution is precipitated by tannic acid T. S., and mercuric chloride T. S. Should be kept in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Antiseptic; it is rapidly absorbed and value due to its partial change into and liberation as formaldehyde in the urine. The urine usually is rendered acid, but should it remain alkaline no decomposition takes place, nor is any antiseptic action secured; solvent for uric acid; similar to piperazine; pyelitis, cystitis, phosphaturia, gonorrhœa, typhoid fever, renders urine clear and acid when loaded with pus, urates and phosphates.

**Paraldehydum.** Paraldehyde.—(Syn., Fr. Paraldéhyde, Elaldéhyde; Ger. Paraldehyd.) A polymer of acetaldehyde,  $\text{C}_6\text{H}_8\text{O}$ .

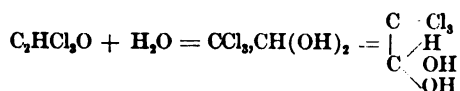


*Manufacture:* Paraldehyde (Gr. *παρά*, resembling, +) is obtained usually by passing hydrochloric acid gas into aldehyde, or by adding to ordinary (ethyl) aldehyde a small quantity of either  $\text{SO}_2$ ,  $\text{HCl}$ ,  $\text{ZnCl}_2$ , or sodium acetate; the temperature of the mixture rises, and almost a complete conversion into paraldehyde takes place. It is a colorless, transparent liquid, characteristic, but not unpleasant, pungent odor, burning, cooling taste, soluble in alcohol, ether, fixed and volatile oils, 8 parts water; crystallizes at  $0^\circ \text{C}$ . ( $32^\circ \text{F}$ .) ( $3\text{C}_2\text{H}_4\text{O} = \text{C}_6\text{H}_{12}\text{O}_3$ ), becoming liquid again at  $10.5^\circ \text{C}$ . ( $51^\circ \text{F}$ .). *Impurities:* Aldehyde from fusel oil, amyl alcohol, hydrochloric acid, sulphuric acid, free acid. Should be kept cool, in well-stoppered, dark amber-colored bottles. Dose,  $\text{M}_{\text{xv}}$ –60 (1–4 Cc.), largely diluted with syrup and flavored with tincture of orange-peel or some aromatic, as the taste is disagreeable.

**PROPERTIES.**—Soporific, hypnotic, antiseptic; no influence over pain. Excessive doses weaken heart-action. Kills by paralysis of the respiratory centre, moderate doses cause 5–7 hours of refreshing, dreamless sleep, without unpleasant after-effects. May create *paraldehyde-habit*, emaciation, etc.

**USES.**—Same indications as hydrated chloral—insomnia from mental strain, insanity, mania, melancholia, delirium tremens, cardiac affections, allays itching in jaundice, vomiting in nauseating headache, pregnancy, and irritable ovary, excellent in strychnine-poisoning, morphine-habit, often produces erythematous rash.

**Chloralum Hydratum. Hydrated Chloral.**—(Syn., Chloral, U. S. P. 1890, Aldehydum Trichloratum, Hydrous Chloral, Trichloraldehyde Hydrate; Br. Chloral Hydras; Fr. Hydrate de Chloral; Ger. Chloralum hydratum, Chloralhydrat.) A crystalline solid composed of trichloraldehyde or chloral with the elements of 1 molecule of water.



*Manufacture:* Chloral (*chlor*(ine) + *al*(cohol)) is acetic aldehyde,  $\text{C}_2\text{H}_4\text{O}$ , in which 3 hydrogen atoms have been replaced by 3 chlorine atoms, and is made, as the name would suggest, by passing dry chlorine gas into anhydrous alcohol until saturated, which requires from a few hours to many weeks, according to amount of alcohol operated upon; when hydrochloric acid gas ceases to distil the temperature is gradually increased to  $100^\circ \text{C}$ . ( $212^\circ \text{F}$ .), and the saturated liquid, which congeals on cooling, is shaken with sulphuric acid to decompose chloral alcoholate, remove alcohol and other impurities; the colorless oily layer that separates is removed and rectified direct over lime and calcium carbonate; this rectified distillate (anhydrous chloral) is mixed with water (82 parts chloral + 10 water), mixture poured upon plates under bell-glass, and allowed to crystallize—hy-

drated chloral— $C_2H_5O + 2Cl = C_2H_4O + 2HCl$ ;  $C_2H_4O + 6Cl = C_2HCl_3O + 3HCl$ . It is in separate, rhomboidal, colorless, transparent crystals, aromatic, penetrating, slightly acrid odor, bitterish, caustic taste, slowly volatile, soluble in water, alcohol, ether, chloroform, benzene, petroleum benzin, carbon disulphide, fixed and volatile oils; liquefies when triturated with equal quantity of either camphor, menthol, thymol, or phenol, melts at  $58^\circ C.$  ( $136^\circ F.$ ) into liquid having sp. gr. 1.575, which crystallizes at  $35-50^\circ C.$  ( $95-122^\circ F.$ ); caustic alkalies, alkaline earths and ammonia decompose it into chloroform and a formate of the base used. *Impurities*: Hydrochloric acid, chlorides, chloral alcoholate. Should be kept cool, dark, in glass-stoppered bottles. Dose, gr. 5–20 (.3–1.3 Gm.), not safe to exceed this on account of its possible cumulative tendency, etc.

PREPARATION.—(Unoff.) *Syrupus Chloral* (Br.), 18 p. c., dose, 3ss–2 (2–8 Cc.).

PROPERTIES.—Externally—antiseptic, vesicant, irritant, anodyne. Internally—soporific, hypnotic, gastric irritant, general depressant (vasomotor centre, also heart becomes slow, feeble, irregular, stopping in diastole), produces sleep quickly, is certain, and has no unpleasant after-effects, circulates in the blood unchanged, may be decomposed finally if urine is alkaline.

USES.—Externally—mixed with camphor, menthol, etc., anodyne in neuralgia, caries of teeth, for toothache, foul sores, ulcers, fetor of feet, chapped nipples, erectile tumor, gonorrhœa, diphtheria, night-sweats. Internally—nervous insomnia from overwork, worry, etc., acute fevers, acute congestion of brain, cerebral inflammation, mania, delirium tremens, tetanus, hysteria, chorea, epilepsy, local spasms, asthma, strangulated hernia, spasm of the glottis, spasmodic croup, hiccup, incontinence of urine, insanity, to relieve pain, nervous headache, angina pectoris, convulsions, whooping-cough, dysentery, typhoid fever, strychnine, hyoscyne, and calabar bean poisoning.

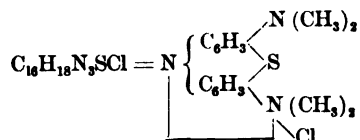
*Poisoning*: Resembles opium somewhat; have deep coma, weak, irregular, slow pulse, pupils dilated when awake, slow respiration, lividity, reflexes abolished, skin cold, temperature below normal. Give emetics or wash out stomach, weak potassium hydroxide solution, cold to head and neck; abundant fresh air, cataplasms, hot bottles, blankets, massage and friction to increase heat; keep awake with coffee, caffeine, galvanism, flagellation, hypodermic strychnine or picrotoxin, inhale amyl nitrite to stimulate heart, artificial respiration.

*Chloral habit (toxæmia, chloralism)* is soon acquired, and is manifested in voluble speech, injected eyes, gastro-intestinal irritation, erythematous eruptions, dyspnoea, general weakness, and permanent mental disturbance. To cure, should withdraw drug, use hygienic and medicinal tonics with cannabis indica.

*Incompatibles*: Alkalies, lime water, atropine, strychnine, external heat.

*Synergists*: Hypnotics, morphine (also lessens heart depression).

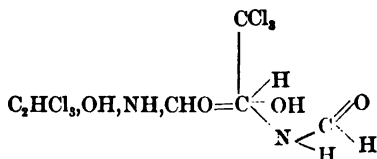
**Methylthioninæ Hydrochloridum. Methylthionine Hydrochloride, Methylene Blue.**—(Syn., Methylenum Cæruleum, Tetramethylthionine Hydrochloride; Fr. Chlorhydrate de Tetraméthylethionine; Ger. Tetramethylthioninchlorid, Methylen Blau.)



**Manufacture:** By treating para-amido-dimethylaniline in hydrochloric acid solution, with hydrogen sulphide, and subsequently with ferric chloride; or act upon para-amido-dimethylaniline hydrochloride with sodium nitrite, hydrogen sulphide and ferric chloride. It is a dark green, crystalline powder, or prismatic crystals with bronze-like lustre, soluble in water, less so in alcohol, the solutions being deep blue color, changing with hydrochloric acid to lighter blue, with sodium hydroxide T. S. to purplish or violet precipitate. **Impurities:** Arsenic, commercial dye, other mineral substances. Dose, gr. 1–5 (.06–.3 Gm.).

**PROPERTIES AND USES.**—Should not be confounded with methyl blue; anodyne, antiperiodic, antipyretic, analgesic, antiseptic; rheumatism, neuralgia, cystitis, intermittent fevers (good substitute for quinine), urethritis, colors urine blue, and may irritate neck of bladder.

**Chloralformamidum. Chloralformamide,  $\text{C}_3\text{H}_4\text{Cl}_3\text{NO}_2$ .**—(Syn., Chloralamide; Ger. Chloralum formamidatum, Chloralformamid.)

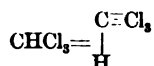


**Manufacture:** Made by the direct union of 147 parts of anhydrous chloral with 45 parts of formamide at ordinary temperature; the resulting solid is purified by crystallization from 30 p. c. alcohol. It occurs in shining, colorless crystals, odorless, slightly bitter taste, soluble in ether, glycerin, acetone, acetic ether, 18.7 parts water, 1.3 alcohol, heated to 60° C. (140° F.) is hydrolized (decomposed) into its components—hydrated chloral and formamide (ammonium formate), melts at 115° C. (239° F.), decomposed at higher temperature, and by warming with alkali hydroxides with separation of chloroform, not affected by diluted acids. **Impurities:** Chloral alcoholate, ethyl carbamate, formic, hydrochloric and other free acids, decomposition products, inorganic substances. Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 10–40 (.6–2.6 Gm.).

**PROPERTIES AND USES.**—Hypnotic. Resembles hydrated chloral,

but produces no harmful after-effects; prolonged administration does not necessitate increase of dose, nor does its use create a habit; the drug does not relieve pain. Useful in painless insomnia, hysteria, asthma, rheumatism, spinal diseases, heart affections, chorea. Owing to its insolubility, absorption and effect are slow, consequently it should be dissolved in alcohol, brandy, or aromatic sulphuric acid. This is one of the best preventives of sea-sickness. Should give a cathartic just before voyage; when aboard ship take gr. 30 (2 Gm.) each of this and potassium bromide on an empty stomach, and then go to bed.

**Chloroformum. Chloroform.**—(Syn., Chloroformum Purificatum, Formylum Trichloratum, Terechloride of Formyl, Dichlor-methyl Chloride; Fr. Chloroforme (pur); Ger. Chloroformium, Chloroform.) A liquid consisting of 99–99.4 p. c. by weight of absolute chloroform and 0.6–1 p. c. of alcohol.



**Manufacture:** Chloroform (*chlor*(ine) + *form*(yl)) is the trichloride of methane, or methyl,  $\text{CH}_4$ , in which 3 hydrogen atoms are removed and replaced by 3 chlorine atoms. In actual practice, water 24 parts, alcohol 1, chlorinated lime 6, are put into a still and heated to  $50^\circ \text{C}$ . ( $122^\circ \text{F}$ .), when chloroform, alcohol and water distil over, the heat from chemical reaction being sufficient to continue the process; the distillate consists of two layers, and the lower is removed, thoroughly washed with water (to get rid of undecomposed alcohol), then repeatedly with sulphuric acid until it is no longer discolored; now treat with solution sodium carbonate, wash with water, dehydrate with calcium chloride, potassium carbonate or phosphoric anhydride, and fractionally distil, collecting that coming over at  $59\text{--}62^\circ \text{C}$ . ( $138\text{--}144^\circ \text{F}$ .). Here the chlorine of the lime converts alcohol into aldehyde, then into chloral, which is decomposed at once by the inherently formed alkali—calcium hydroxide—into chloroform and calcium formate,  $\text{Ca}(\text{CHO}_2)_2$ , hence the various names— $2\text{C}_2\text{H}_6\text{O} + \text{Ca}(\text{OCl})_2 = 2\text{C}_2\text{H}_4\text{O} + \text{CaCl}_2 + 2\text{H}_2\text{O}$ ;  $2\text{C}_2\text{H}_4\text{O} + 3\text{Ca}(\text{OCl})_2 = 2\text{C}_2\text{HCl}_3\text{O} + 3\text{Ca}(\text{OH})_2$ ;  $2\text{C}_2\text{HCl}_3\text{O}$  (chloral) +  $\text{Ca}(\text{OH})_2 = 2\text{CHCl}_3 + \text{Ca}(\text{CHO}_2)_2$ . This process has now given way to that of acetone, which consists in distilling acetone (10) diluted with water (30) + chlorinated lime (100) with water (300); purify as above— $2\text{C}_3\text{H}_6\text{O} + 3\text{Ca}(\text{OCl})_2 = 2\text{C}_3\text{H}_5\text{OCl}_3 + 3\text{Ca}(\text{OH})_2$ ;  $2(\text{C}_3\text{H}_5\text{OCl}_3) + \text{Ca}(\text{OH})_2 = 2\text{CHCl}_3 + \text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ . Chloroform is a heavy, clear, colorless, mobile, diffusible liquid, characteristic, ethereal odor, burning, sweet taste, sp. gr. 1.476, soluble in alcohol, ether, benzene, petroleum benzin, fixed and volatile oils, 200 parts water, volatile, boils at  $60^\circ \text{C}$ . ( $140^\circ \text{F}$ .), non-inflammable, but its heated vapor burns with a green flame. **Impurities:** Chlorides, free chlorine, substances decomposable by sulphuric acid (dark), chlorinated

and odorous decomposition compounds. Should be kept cool, dark, in glass-stoppered, dark amber-colored bottles.

**Purification:** When chloroform contains any of the preceding, it should be purified by taking 400 Gm. and shaking with  $\text{H}_2\text{SO}_4$  80 Gm. occasionally for 24 hours, avoiding exposure to bright daylight; this process chars and removes hydrocarbons; now separate lighter chloroform layer and shake it with dried  $\text{Na}_2\text{CO}_3$  20 Gm. to free from acid, transfer chloroform to dry retort, add deodorized alcohol 4 Cc., and distil at  $67^\circ \text{C}$ . ( $153^\circ \text{F}$ .) until the distillate measures 255 Cc. Dose,  $\text{Mij}$ –20 (.13–1.3 Cc.).

**PREPARATIONS.**—1. *Aqua Chloroformi*. Chloroform Water. (Syn., Fr. Eau de Chloroforme; Ger. Chloroformwasser.)

**Manufacture:** Add enough chloroform (4 Cc.) to a convenient quantity of distilled water (750 Cc.) in a dark amber-colored bottle, to maintain slight excess of former after thorough agitation; when required for use pour off needed quantity, refill with distilled water, shake, always keeping chloroform present in excess. Dose,  $\text{zj}$ –4 (4–15 Cc.).

2. *Emulum Chloroformi*. Emulsion of Chloroform. (Syn., Mixture Chloroformi, Chloroform Mixture, Emulsio Chloroformi; Fr. Emulsion de Chloroforme; Ger. Chloroform-emulsion.)

**Manufacture:** Put tragacanth 1 Gm. into a dry bottle, add chloroform 4 Cc., shake thoroughly, add water 25 Cc., shake, add in portions expressed oil of almond 6 Cc., shaking after each addition, add water q. s. 100 Cc. Dose,  $\text{zj}$ –4 (4–15 Cc.).

3. *Linimentum Chloroformi*. Chloroform Liniment. (Syn., Fr. Liniment au Chloroforme; Ger. Chloroformliniment.)

**Manufacture:** Mix by agitation chloroform 30 Cc. and soap liniment 70 Cc. Used externally.

4. *Spiritus Chloroformi*. Spirit of Chloroform. (Syn., Br. Chloric Ether, Spirit of Chloric Ether; Fr. Alcoolat (Alcoolé) de Chloroforme; Ger. Chloroformspiritus.)

**Manufacture:** Mix chloroform 6 Cc. and alcohol 94 Cc. Dose,  $\text{ss}$ –1 (2–4 Cc.).

**Unoff. Prep.:** *Tinctura Chloroformi et Morphine Composita* (Br.), chloroform 7.5 p. c., morphine hydrochloride 1 p. c., dose,  $\text{Mv}$ –15 (.3–1 Cc.).

**PROPERTIES.**—Internally—irritant, anæsthetic locally, astringent, stimulant, narcotic. The *first stage* is that of general stimulation, excited imagination, feeling of warmth and comfort, mind incoherent, confused, pupils dilated, may laugh, kick, fight, vomit, or cry unconsciously, pulse increases, heart and great vessels throb, may have choking, cessation of breathing, flushed face; the *second stage* is that of depression, complete unconsciousness, sees, hears, and feels nothing; *third stage* is that of total abolition of reflex excitability, may pass urine and fæces involuntarily. Externally—irritant, vesicant, anæsthetic. Should not be given to those having lung affections, fatty or feeble hearts, nor to the very old.

**USES.**—Internally or inhalation—toothache, dyspepsia, setting fractured bones, dislocations, strangulated hernias, hiccough, chorea, hysteria, whooping-cough, asthma, angina pectoris, biliary and nephritic colic, tetanus, hydrophobia, tic douloureux, vomiting of pregnancy, labor, painter's colic, dysmenorrhœa, spasms of bladder or rectum, gastric ulcer, colic, pain from calculi, convulsions, fevers. Externally—toothache, headache, rheumatism, neuralgia, dysmenorrhœa, painful parturition, swelled testicle, hemorrhoids, hemorrhage, tænia.

When inhaled, should be with abundance (95 p. c.) of air. It requires usually 2–3 minutes to produce insensibility (much more quickly than with ether), which lasts only 5–10 minutes, unless inhalation is continued or morphine injected, which latter prolongs the effect considerably. One fluidrachm (250 drops; 4 Cc.) will suffice for each inhalation, though more at the initial stage often is required.

**Poisoning:** Have irregular, shallow, stertorous breathing, dilated pupils. If swallowed, empty the stomach by pump, siphon, or emetics, give enema of hot coffee, large draughts of water containing sodium bicarbonate, demulcents, and treat as if inhaled, thus: Lower the head, pull forward the tongue to admit air, artificial respiration for an hour, electricity, hot and cold douche, inhale amyl nitrite, ether, ammonia, friction, heat, give brandy, atropine, strychnine. One death occurs in every 3,000 inhalations. On recovery, first the muscles regain power of involuntary motion, sensibility next is regained, and lastly consciousness, which may require hours for perfect restoration. There is never remembrance of occurrences during the insensibility; even the nausea, vomiting, etc., are wholly involuntary.

**Incompatibles:** Weak alcoholic spirits, glycerin, stimulants, galvanism.

**Synergists:** Anæsthetics, alcohol, hydrated chloral, morphine, etc.

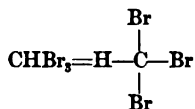
**Allied Product:**

1. *Chloretone*,  $C_4H_7OCl_3$ .—Obtained by the interaction of chloroform, acetone, and an alkali, and occurs in white crystals, soluble in alcohol, largely in warm water, sparingly in cold, sublimates at body temperature into white glistening needles, stable in presence of diluted acids and alkalies; permanent, non-toxic, non-irritating.

**PROPERTIES AND USES.**—Hypnotic, analgesic, local anæsthetic, anodyne, sedative, antiseptic; resembles cocaine, but has less toxic effects upon the heart; slightly lessens pulse-rate, but does not reduce force of cardiac systole nor lower the blood-pressure; considered superior to cocaine, beta-eucaine, hydrated chloral, sulphonal, trional, etc., for insomnia, gastric carcinoma, gastritis, sea-sickness, vomiting of pregnancy, nausea, wounds, cuts, abrasions, minor operations. Dose, gr. 5–15 (.3–1 Gm.); apply locally the powder or saturated aqueous solution.

Chloroform made by the acetone process has been sold under this name, with the recommendation of its not reducing the force of cardiac systole nor lowering blood-pressure.

**Bromoformum.** Bromoform.—(Syn., Methyl Tribromide, Tribrom-methane, Dibromomethyl-bromide ; Gr. Bromoformium.)

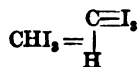


**Manufacture:** Chlorinated lime (60) is made into paste with water and added to potassium bromide (71.5) dissolved in water (150), add acetone (12), distil in current of steam until oily drops cease to come over, cool apparatus, add chlorinated lime (60), acetone (9), distil, repeat this operation three times with similar parts of chlorinated lime and acetone, wash distillates, shake with sulphuric acid, again wash with water, and solution sodium hydroxide, dehydrate with fused calcium chloride, distil at 150° C. (302° F.), reserving the distillate ; or add bromine gradually to solution potassium hydroxide in alcohol as long as the color is discharged, distil. It is a heavy, transparent, colorless, mobile liquid, ethereal odor, penetrating, sweet taste, resembling chloroform, soluble in alcohol, ether, benzene, petroleum benzin, fixed and volatile oils, slightly in water, sp. gr. 2.808, slightly volatile, boils at 148° C. (298° F.), solidifies at 6° C. (43° F.), no residue, non-inflammable, decomposes on exposure, prevented by adding 1 p. c. of alcohol ; contains 99 p. c. by weight of absolute bromoform and 1 p. c. of alcohol ; = 94.85 p. c. of bromine ; a fluidrachm represents 360 drops. **Impurities:** Free bromine, free acid, acetone, bromides, brominated compounds, alcohol. Should be kept dark, cool, in glass-stoppered, dark amber-colored bottles. Dose, Mij-5 (.13-.3 Cc.), on sugar, or in capsules, or in alcohol, glycerin, or compound tincture of cardamom.

**PROPERTIES AND USES.**—Anæsthetic by inhalation, but has caused alarming symptoms, sufficient to prevent its employment ; like chloroform depresses reflex centres of spine, decreasing their functions ; produces sleep, insensibility to pain by depressing action upon cerebral centres ; depresses vasomotor centre, lessening blood pressure thus dissipates heat ; pulse remains full and strong, as heart and peripheral vagi are seemingly not affected. Chiefly employed internally as a palliative in whooping-cough, decreasing the number and intensity of paroxysms, but does not shorten the disease, also given for hiccough, spasmodic asthma, laryngismus stridulus, cough of phthisis, chronic bronchitis, reflex headache, vertigo.

**Poisoning:** Laughing intoxication, nausea, vomiting, cyanosis, loss of reflex action, coma, collapse, cardiac failure, extreme pallor, fatty degeneration of the viscera. Use external heat, hypodermic ether and strychnine, electricity, which generally return consciousness in 4-6 hours.

**Iodoformum.** Iodoform.—(Syn., Diiodomethyl-iodide, Carboneum Judatum, Ioduretum Carbonici, Triiodomethane ; Fr. Iodure de Formyle, Iodoforme ; Ger. Jodoformium, Jodoform.)





**Manufacture:** Iodoform (iod(ine) + (chlor)ofom) is the triiodide of methane, or methyl ( $\text{CH}_4$ ), where 3 hydrogen atoms are removed and replaced by 3 iodine atoms, as is chlorine in chloroform. In practice made by heating together alcohol, iodine, and potassium bicarbonate— $\text{C}_2\text{H}_5\text{OH} + 4\text{I}_2 + 2\text{KHCO}_3 + \text{heat in a closed vessel} = 2\text{CHI}_3 + 2\text{KI} + 3\text{H}_2\text{O} + 2\text{CO}_2$ . In this process  $\text{K}_2\text{CO}_3$  or  $\text{KOH}$  may be substituted for  $\text{KHCO}_3$ . It is in small, lemon-yellow, lustrous, hexagonal crystals; odor peculiar, penetrating, persistent, resembling saffron and iodine; taste unpleasant, sweetish, iodine-like; contains 96.69 p. c. of iodine; sp. gr. 2.000, soluble in chloroform, fixed and volatile oils, 46.7 parts alcohol, 5.2 ether, 9,391 water. **Impurities:** Fixed substances, soluble yellow coloring matters, picric acid, free acids, soluble iodides. **Tests:** 1. Digest 0.1 Gm. with 5 Cc. alcoholic solution potassium hydroxide (1 in 20) until dissolved, evaporate to dryness, dissolve residue in 5 Cc. distilled water, add 2 Cc. chloroform, + excess nitric acid, shake, when chloroform should assume violet color. Should be kept cool, dark, in well-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.), in pill; applied externally as ointment, in collodion, alcohol, liniments, suppositories, gauzes, etc., or in dry powder.

**PREPARATIONS.**—1. *Unguentum Iodoformi*. Iodoform Ointment. (Syn., Fr. Pommade d'Iodoforme; Ger. Jodoformsalbe.)

**Manufacture:** 10 p. c. Rub iodoform 10 Gm. with lard 90, gradually added, until thoroughly mixed.

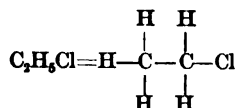
**PROPERTIES.**—Internally—increases appetite, narcotic, eliminated by secretions, chiefly in urine, as iodine, iodides, and iodates. Externally—antiseptic, disinfectant, analgesic, local stimulant, anæsthetic.

**USES.**—Externally—ulcers, sores, wounds, tuberculous and syphilitic ulcers, cancer, metritis, endometritis, swollen glands, pleural effusions, also of pericardium, inflamed joints, diphtheria, chronic cystitis, goitre, gonorrhœa, buboes, ozæna, ulcer of tongue, chronic otorrhœa, ringworm of scalp, purulent ophthalmia, ulcerated eyelids, corneal ulcers, hemorrhoids, lupus, pruritus of vagina and testes, skin diseases (eczema, psoriasis, prurigo), erysipelas, ulcers of larynx, nasal catarrh, gangrene, vaginismus, neuralgia, heart disease, orchitis, carious teeth, boils, carbuncles, scrofula. The odor may be modified by the addition of some aromatic substance, such as vanillin, musk, oils of bergamot, lavender, peppermint, sassafras, etc., balsam of Peru, thymol, eucalyptol, etc.

**Poisoning:** Usually have symptoms of meningitis—headache, stupor, gastro-intestinal irritation, melancholia, hallucinations, contracted pupils, high temperature, erythema, delirium, rapid pulse, death. Give potassium bromide, which dissolves the iodine compound, lemonade, potassium acetate solutions, stimulants, diaphoretics, diuretics, warm sponge bath, small repeated doses of tincture of opium, large doses of potassium bicarbonate, diluents freely.

**Incompatibles:** Mercuric chloride, etc.

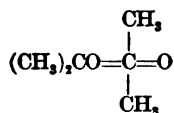
**Æthylis Chloridum. Ethyl Chloride.**—(Syn., Æthylum Chloratum, Æther Chloratus, Mono-chlor-ethan, Hydrochloric Ether; Fr. Chlorure d'Ethyle, Ether hydrochlorique; Ger. Chlorwasserstoffäther.) A haloid derivative, monochlor-ethane,  $C_2H_5Cl$ , prepared by the action of hydrochloric acid gas upon absolute ethyl alcohol.



**Manufacture:** Equal measures of alcohol and hydrochloric acid are distilled under pressure at  $150^\circ \text{C}$ . ( $302^\circ \text{F}$ .)— $C_2H_5OH + HCl = C_2H_5Cl + H_2O$ . It is a colorless, mobile, very volatile liquid, characteristic, agreeable odor, burning taste, sp. gr. 0.918, boils at  $13^\circ \text{C}$ . ( $55^\circ \text{F}$ .), soluble in alcohol, slightly in water, at ordinary room-temperature when liberated from its sealed glass tube vaporizes at once, the gas being very inflammable, consequently should not be used in proximity to gas-flame or fire. Comes on the market in small glass tubes, the pointed apex of which is broken off and the ethyl chloride vaporized by heat of the hand. Should be kept cool, remote from lights or fire, in hermetically-sealed glass tubes. Dose,  $\text{m}x-30$  (.6–2 Cc.).

**PROPERTIES AND USES.**—Local and general anæsthetic; in the former it freezes the part, producing white spot, and not until then is the incision made; used to benumb nerves in supraorbital neuralgia; in minor surgical operations, dentistry, etc.

**Acetonum. Acetone.**—(Syn., Acetyl-methylid, Dimethyl-ketone, Spiritus Pyroaceticus, Pyroacetic Spirit; Fr. Esprit pyroacétique; Ger. Essiggeist, Mesitalkohol.)



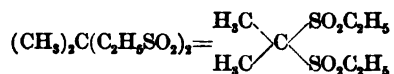
**Manufacture:** By the dry distillation of wood, of acetates, citric acid, sugar (carbohydrates) + lime, but chiefly from calcium acetate— $Ca(C_2H_3O_2)_2$  + dry distillation =  $(CH_3)_2CO + CaCO_3$ ; the distillate is neutralized with dry sodium carbonate, treated with calcium chloride and purified by fractional distillation over lime; now made largely by decomposing acetic acid vapor by passing it through a rotating iron cylinder containing pumice stone and precipitated barium carbonate, at a temperature of  $500-600^\circ \text{C}$ . ( $932-1112^\circ \text{F}$ .)— $2HC_2H_3O_2 + \text{heat} = C_3H_6O + CO_2 + H_2O$ . It is a transparent, colorless, inflammable, volatile liquid, characteristic ethereal, mint-like odor, refreshing, pungent, sweetish taste; sp. gr. 0.790, boils at  $56^\circ \text{C}$ . ( $134^\circ \text{F}$ .); miscible with water, alcohol, ether, chloroform, and volatile oils; does not affect

litmus-paper, no residue; contains 99 p. c., by weight, of acetone. *Tests*: 1. With iodine + alkali produces iodoform. 2. 20 Cc. + 0.1 Cc.  $\frac{N}{10}$  potassium permanganate V. S., the pink tint should not disappear in less than 15 minutes (lim. of empyreumatic substances). *Impurities*: Alcohol, water, etc., which increase the specific gravity. Should be kept cool, remote from lights, fire, in well-closed vessels. Dose,  $\text{m}\bar{x}$ -20 (.6-1.3 Cc.).

**PROPERTIES AND USES.**—Anæsthetic, soporific, anthelmintic, rheumatism, gout, nausea, diarrhœa, mostly as a solvent for resins, fats, oleoresins, camphor, gun-cotton, preparing chloroform—yielding of this 200 p. c. of its own weight when distilled with water and calcium hypochlorite.

## 2. SULPHUR DERIVATIVES.

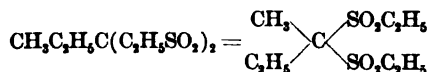
**Sulphonmethanum.** Sulphonmethane,  $\text{C}_7\text{H}_{16}\text{S}_2\text{O}_4$ . — (Syn., Sulphonalum, Sulphonal, Diethylsulphonedimethylmethane; Fr. Acetone-dimethylsulphone; Ger. Sulfonal.) The product of the oxidation of the mercaptol obtained by the condensation of acetone with ethyl mercaptan.



*Manufacture*: Dry hydrochloric acid gas is passed into a mixture of 2 parts of anhydrous ethyl hydrosulphide (mercaptan,  $\text{C}_2\text{H}_5\text{SH}$ ), and 1 part of anhydrous acetone; two layers are formed, the upper being dithio-ethyl-dimethyl-methane or mercaptol; this is purified by distillation and oxidized with  $\text{KMnO}_4$ , thus yielding sulphonal. It occurs in white, colorless, prismatic crystals, odorless, tasteless, soluble in 360 parts water, 47 alcohol, 45 ether, 16 chloroform, heated gives off  $\text{SO}_2$ , no residue. *Tests*: 1. Heat 0.1 Gm. + 0.1 Gm. charcoal get unpleasant odor of mercaptan; with sodium acetate get  $\text{H}_2\text{S}$ . *Impurities*: Sulphates, chlorides, readily oxidizable organic substances. Should be kept in well-stoppered vials. Dose, gr. 15-30 (1-2 Gm.).

**PROPERTIES AND USES.**—Hypnotic, sedative. Resembles hydrated chloral, but is less apt to affect the heart; kills, however, by paralysis of respiration; it is given for the same conditions as hydrated chloral, but being so insoluble is absorbed slowly, hence is tardy in action; insomnia, delirium, typhoid fever, diabetes. Give an hour before bedtime in wine, beer, elixir, soup, milk, hot water, tablet or capsule.

**Sulphonethylmethanum.** Sulphonethylmethane,  $\text{C}_8\text{H}_{18}\text{S}_2\text{O}_4$ . — (Syn., Trionalum, Trional, Diethylsulphonemethylethylmethane; Fr. Diéthylsulfone-méthyléthylméthane; Ger. Methylsulphonalum, Methylsulphon.) The product of the oxidation of the mercaptol obtained by the condensation of methylethylketone with ethylmercaptan.



**Manufacture:** Like sulphonal, except begin with methylethylketone instead of acetone. It is in colorless, lustrous, odorless, crystalline scales, bitter, soluble in 195 parts water, readily in alcohol, ether, heated gives off  $\text{SO}_2$ , no residue. **Tests:** 1. Heat 0.1 Gm. + 9.1 Gm. charcoal get unpleasant odor of mercaptan; with sodium acetate get  $\text{H}_2\text{S}$ . **Impurities:** Sulphates, chlorides, readily oxidizable organic substances. Should be kept in well-stoppered vials. Dose, gr. 15–30 (1–2 Gm.).

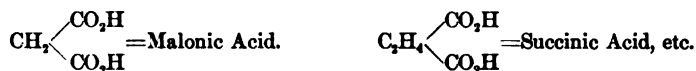
**PROPERTIES AND USES.**—Hypnotic, sedative for the insane. Has prompt action without cumulative effect or tendency to create a habit; quicker and more certain than sulphonal, and largely used.

#### IV. Acids.

Acids are obtained from hydrocarbons by removing a hydrogen atom and substituting for it the univalent group carboxyl,  $\text{CO}_2\text{H}$ , or from alcohols by replacing 2 hydrogen atoms with 1 oxygen atom, thus:



When this substitution is 1 hydrogen atom for 1 carboxyl we have resulting monobasic acids; when 2 hydrogen atoms are replaced by 2 carboxyl we have dibasic acids, etc., thus:



##### 1. MONOBASIC FATTY ACIDS.

(These have 1 hydrogen atom replaceable by metals.)

**Acidum Aceticum.** Acetic Acid,  $\text{HC}_2\text{H}_3\text{O}_2 = \text{CH}_3\text{COOH}$ .—(Syn., Fr. Acide acétique; Ger. Essigsäure.) A liquid composed of 36 p. c. by weight of absolute acetic acid,  $\text{HC}_2\text{H}_3\text{O}_2$ , and 64 p. c. of water.

**Manufacture:** While this may be obtained by the oxidation of ethyl alcohol, most of it is the result of the dry distillation of wood, preferably white oak (*Quercus alba*), which is dry distilled at  $205^\circ \text{C}$ . ( $401^\circ \text{F}$ .) for 7 days; gases, such as acetylene,  $\text{C}_2\text{H}_2$ , ethylene,  $\text{C}_2\text{H}_4$ , propene,  $\text{C}_3\text{H}_6$ , marsh gas,  $\text{CH}_4$ , carbon-dioxide,  $\text{CO}_2$ , etc., escape; the wood, losing one-half in weight, becoming walnut-colored, but retaining original structure and elementary composition, remains in the retort, as does also a dark liquid, in two strata, at the bottom: the upper—aqueous, slightly colored, amounts to about 30 p. c. of the original weight of wood taken, and is crude wood vinegar or pyroligneous acid, containing also methyl alcohol, acetone, guaiacol, pyrocatechin, furfural, etc.; the lower—oily, is tarry and contains creosote, etc. The upper liquid is distilled, the first 10 p. c. going over being alcohol and acetone, while the next 75–80 p. c. is a yellow liquid, *acetum pyrolignosum rectificatum*, P. G., with about 6 p. c. of acetic acid. This

is now boiled with milk of lime, or neutralized with soda ash or sodium carbonate, giving calcium or sodium acetate in solution (if milk of lime used, should double decompose with sodium sulphate to get sodium acetate), filter solution, concentrate, crystallize, and distil this with  $\text{H}_2\text{SO}_4$ , when we get acetic acid of desired strength; thus,  $\text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{SO}_4 = \text{HC}_2\text{H}_3\text{O}_2 + \text{NaHSO}_4$ . A more modern method, and one now usually employed, consists in securing from charcoal-burners the acetic acid in the form of calcium acetate, dissolving and decomposing it with sodium sulphate, thus precipitating calcium sulphate and leaving sodium acetate in solution, which in turn is filtered and treated as the above similar solution. Acetic acid is a clear, colorless liquid, strong, vinegar-like odor, acid taste, sp. gr. 1.045, miscible with water, alcohol, volatile. *Test*: 1. When neutralized with ammonia water, ferric chloride T. S. gives blood-red color, discharged by sulphuric acid. *Assay*: 10 Gm. + water q. s. 100 Cc., of this 59.6 Cc. should require 36 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. of V. S. corresponding to 1 p. c. of absolute acid), using methyl-orange T. S. indicator. *Impurities*: Heavy metals, copper, formic, hydrochloric, sulphuric, sulphurous acids, empyreumatic and fixed substances.

*PREPARATION*.—1. *Acidum Aceticum Dilutum*. Diluted Acetic Acid. (Syn., Fr. Acide acétique dilué; Ger. Acetum Purum (Destillatum), Acidum aceticum dilutum, Verdünnte Essigsäure.)

*Manufacture*: Mix acetic acid 100 Gm. with distilled water 500 Gm. It contains 6 p. c. by weight of absolute acetic acid, sp. gr. 1.009. *Assay*: To neutralize 23.8 Gm. should require 24 Cc. normal potassium hydroxide V. S. (each Cc. of V. S. corresponding to 0.25 p. c. of absolute acid), using methyl-orange T. S. indicator. Dose, 3j–4 (4–15 Cc.).

Much of the weaker acetic acid is the result of weak alcohol or aldehyde oxidation, made by allowing diluted alcohol (8–10 p. c.) to trickle downward through wood-shavings packed in barrels, so as to afford free circulation of air, the percolate being returned so often as (four times) required for complete oxidation. The presence of the growth "mother of vinegar" (*Mycoder'na ace'ti*) facilitates greatly the conversion— $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 = \text{C}_2\text{H}_3\text{O}_2\text{OH} + \text{H}_2\text{O}$ . This is usually called vinegar, and contains about 4–5 p. c. of pure acetic acid.

*Acidum Aceticum Glaciale*. Glacial Acetic Acid,  $\text{HC}_2\text{H}_3\text{O}_2$ .—(Syn., Br. Acidum Aceticum (Concentratum), Acetum Glaciale; Fr. Acide acétique (concentré) Crystallizable, Esprit de Vinaigre, Acetum glaciale, Vinaigre Glacial; Ger. Essigsäure, Eisessig.)

*Manufacture*: Sodium acetate 13.5 parts, deprived of water of crystallization (then making 8.25 parts), is distilled with  $\text{H}_2\text{SO}_4$  9.5 to 10 parts, when the distillate can be evaporated and crystallized at  $0^\circ\text{C}$ . ( $32^\circ\text{F}$ ).— $\text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{SO}_4 = \text{HC}_2\text{H}_3\text{O}_2 + \text{NaHSO}_4$ . Every 136 parts of crystallized sodium acetate yields 60 parts of acetic acid. It is a clear colorless liquid, strong, vinegar-like odor, pungent, acid taste, sp. gr. 1.049, slightly below  $15^\circ\text{C}$ . ( $59^\circ\text{F}$ .) becomes a crystal-

line solid, boils at 118° C. (244° F.), miscible with water, alcohol, ether, chloroform; contains 99 p. c., by weight, of absolute acid. *Assay*: Weigh accurately 3 Cc., dilute with 50 Cc. distilled water, titrate with normal potassium hydroxide V. S., using methyl-orange T. S. indicator, multiply number Cc. of V. S. consumed by 5.958, divide product by weight of acid taken, quotient = p. c. of absolute acid. *Impurities*: As found in market may be adulterated with mineral acids ( $H_2SO_4, HCl$ ), arsenic, lead, zinc, copper, tin, wood vinegar, coloring matter, capsicum.

**PROPERTIES.**—Corrosive, irritant, refrigerant, astringent.

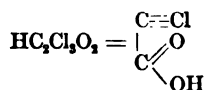
**USES.**—Vapor applied to nostrils as an excitant in syncope, asphyxia, headache. Glacial Acid—mostly applied externally to warts, corns, for blistering, favus, lichen, prurigo, psoriasis, cancer, nasal polypus.

*Allied Products*:

1. *Acetum. Vinegar.*—Official 1820–1880. Obtained by the acetous fermentation of infusions of malted and unmalted grain, or of various fruit juices.

2. *Acidum Aceticum Empyreumaticum. Pyroligneous Acid.*—Official 1830–1840. (Syn., Fr. Acide acétique du bois, Acide pyroacétique (pyroligneux); Ger. Rother Holzessig(säure).) Obtained by the destructive distillation of wood; yield of acetic acid 6–8–9 p. c.

**Acidum Trichloraceticum. Trichloracetic Acid,  $HC_2Cl_3O_2$ .**—(Syn., Chloracetic Acid; Fr. Acide trichloracetique; Ger. Trichloresigsäure.) A monobasic organic acid usually obtained by the oxidation of hydrated chloral with nitric acid.



**Manufacture**: Add fuming nitric acid 63 Gm. to hydrated chloral 165.5 Gm., previously fused at 58° C. (136° F.), set aside mixture for an hour, or until red vapors cease to be formed, then carefully distil at 190° C. (374° F.). It is in white, deliquescent, rhombohedral crystals, slight characteristic pungent odor, soluble in water, alcohol, ether, aqueous solution by boiling is decomposed into chloroform and carbon dioxide, melts at 52° C. (126° F.), boils and vaporizes at 195° C. (383° F.). **Tests**: 1. Heated with potassium hydroxide T. S. decomposes into chloroform and potassium carbonate; ferric chloride T. S. gives faint reddish color. **Assay**: 1 Gm. + 50 Cc. water should require 6.1 Cc. normal sodium hydroxide V. S. for neutralization, using phenolphthalein T. S. indicator.

**PROPERTIES AND USES.**—Antiseptic, escharotic. Penetrates deeply, but causes less pain than either silver nitrate, zinc chloride, or potassium hydroxide. Removes warts, condylomata, lupus, diseases of the nose and throat; used here in preference to chromic acid.

**Acidum Oleicum. Oleic Acid,  $HC_{18}H_{33}O_2$ .**—(Syn., Acidum (Oleicum) Elainicum, Elaïc Acid; Fr. Acide oléique; Ger. Oleinsäure,

Oelsäure.) A monobasic organic acid prepared in a sufficiently pure condition by cooling commercial oleic acid to about 5° C. (41° F.), then separating and preserving liquid portion.

*Manufacture*: Digest almond oil with lead oxide and water, when dry separate oleate of lead from other salts by solution in ether, precipitate lead from ethereal solution with hydrochloric acid, evaporate filtrate; large quantities are obtained also as a by-product in making stearic acid for stearin candles. It is a yellow or brownish-yellow, oily liquid, peculiar lard odor and taste, darkens by age, sp. gr. 0.895, soluble in alcohol, chloroform, benzene, petroleum benzin, fixed and volatile oils, solidifies at 4° C. (39° F.); begins to decompose at 95° C. (203° F.), at higher temperature is dissipated completely. *Impurities*: Fixed oils, palmitic and stearic acids.

*PREPARATIONS*.—1. *Oleatum Atropinae*, 50 p. c. 2. *Oleatum Cocainae*, 50 p. c. 3. *Oleatum Hydrargyri*, 75 p. c. 4. *Oleatum Quininae*, 75 p. c. 5. *Oleatum Veratrinae*, 50 p. c.

*PROPERTIES AND USES*.—Important, since it is a solvent for medicines to be applied by inunction and the base of official oleates, which do not decompose (becoming rancid, etc.) like ointments, and enter the skin deeper without irritation.

Oleate of Mercury—good in skin diseases (sycosis, chloasma, pediculi), syphilitic affections, thinning and loss of hair. Oleates of zinc and veratrine are very useful, as are also several unofficial oleates.

*Acidum Stearicum*. *Stearic Acid*,  $\text{HC}_{18}\text{H}_{35}\text{O}_2$ .—(Syn., Fr. *Acide stéarique*; Ger. *Stearinsäure*.) A monobasic organic acid in its commercial, more or less impure, form, usually obtained from the more solid fats, chiefly tallow.

*Manufacture*: This exists as the glyceride in all solid animal fats and in many oils, and is prepared from tallow by boiling with NaOH or  $\text{K}_2\text{CO}_3$ ; this forms sodium stearate (soap) and liberates glycerin— $\text{C}_3\text{H}_5(\text{C}_{18}\text{H}_{35}\text{O}_2)_3 + 3\text{NaOH} = \text{C}_3\text{H}_5(\text{OH})_3 + 3\text{NaC}_{18}\text{H}_{35}\text{O}_2$ . The soap is decomposed by heating with water and  $\text{H}_2\text{SO}_4$  (or HCl), thus setting free the fatty acids, which, floating on the surface, are removed; upon cooling, the solid acid mixture is subjected to strong pressure, thereby removing the fluid acids, oleic, etc. It is a hard, white glossy solid, odorless, tasteless, permanent, soluble in ether, 16.6 parts alcohol, insoluble in water, melts at 56–69° C. (133–157° F.), then congeals at 54° C. (129° F.). *Impurities*: Undecomposed fat, etc.

*PREPARATION*.—1. *Suppositoria Glycerini*, 7½ gr. (.5 Gm.) in each.

*PROPERTIES AND USES*.—Mainly in manufacturing glycerin suppositories, and as zinc and copper stearates, for various skin diseases.

## 2. DIBASIC FATTY ACIDS.

(These have 2 hydrogen atoms replaceable by metals.)

**Acidum Oxalicum. Oxalic Acid,  $H_2C_2O_4 \cdot 2H_2O$ .**—(Syn., Fr. Acide oxalique ou carboneux; Ger. Oxalsäure, Kleesäure.) Composed of two carboxyl groups,  $CO_2H + CO_2H$ .

**Manufacture:** Found in many plants (*Oxalis*, *Rumex*, *Rheum*, and other genera) as acid calcium or potassium oxalate, also in urine as calcium oxalate. May be made by oxidizing many organic substances, fats, sugars, starch, etc., with nitric acid or other strong oxidizing agents. Produced on the large scale by heating sawdust with KOH and NaOH at  $250^\circ C.$  ( $482^\circ F.$ ), when oxalate of these is formed, now add calcium hydroxide to alkaline oxalate solution, giving insoluble calcium oxalate, which is decomposed by  $H_2SO_4$  or HCl. It occurs in large transparent, colorless crystals, soluble in water, alcohol, very poisonous, heated highly splits into  $H_2O$ ,  $CO_2$ , CO.

**PREPARATION.**—1. *Tenth-normal Oxalic Acid Volumetric Solution.*

**Manufacture:** Pure oxalic acid 6.4 Gm., distilled water q. s. 1,000 Cc.

**PROPERTIES AND USES.**—Poisonous, reducing agent, decolorizes permanganate solutions, precipitates gold and platinum solutions, removes iron stains from linen, paper, fabrics. Acid potassium oxalates under names *salt of sorrel*, *salt of lemon*, are also much used in decolorizing tissues of various kinds. Owing to close resemblance of oxalic acid to Epsom salt, fatal poisonings have resulted from mistaking the former for the latter.

**Poisoning:** Have vomiting, burning pain, constriction of throat and stomach, collapse, drowsiness, stupor, dark-colored discharges, death. Empty stomach, then give powdered chalk, whitening, or wall-plaster in water, slaked lime (lime water), dried whitewash, to form insoluble oxalate, hot fomentations to loins, enema, oil, abundant water, opium.

**Acidum Tartaricum. Tartaric Acid.**—(Syn., Sal Essentiale Tartari, Dioxysuccinic Acid; Fr. Acide du Tartre, Acide tartrique; Ger. Acidum tartaricum, Weinsäure, Weinsteinsäure.) A dibasic organic acid, usually prepared from argol.

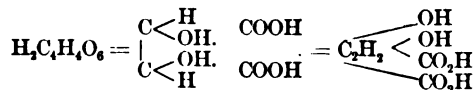


FIG. 461.



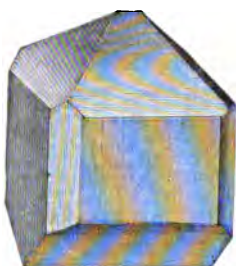
Oxalic acid crystal.

**Manufacture:** Tartaric acid is found in vegetables and fruits, free and combined with potassium or calcium. The grape contains most, having it in the form of potassium acid tartrate, crude tartar, or argol. This substance is soluble in an aqueous saccharine solution, as of fresh



grape juice; but when the weak saccharine solution begins to ferment alcohol is formed, in which argol is not soluble, consequently it is precipitated. Although argol is principally potassium acid tartrate, it also contains some calcium, magnesium, iron and aluminum salts. It is dissolved in water at 140–170° C. (284–338° F.) under pressure, clear solution not quite neutralized with chalk, adding only until effervescence nearly ceases, in order to retain in solution the magnesium, iron, and aluminum salts— $2\text{KHC}_4\text{H}_4\text{O}_6 + \text{CaCO}_3 = \text{CaC}_4\text{H}_4\text{O}_6 + \text{K}_2\text{C}_4\text{H}_4\text{O}_6 + \text{CO}_2 + \text{H}_2\text{O}$ ; calcium chloride is now added to the hot mixture to convert remaining soluble normal potassium tartrate into insoluble calcium tartrate— $\text{K}_2\text{C}_4\text{H}_4\text{O}_6 + \text{CaCl}_2 = \text{CaC}_4\text{H}_4\text{O}_6 + 2\text{KCl}$ ; the resulting calcium tartrate is washed and heated with diluted sulphuric acid at 75° C. (167° F.); the solution of free acid is evaporated in lead vacuum pans and allowed to crystallize in lead-lined vats— $\text{CaC}_4\text{H}_4\text{O}_6 + \text{H}_2\text{SO}_4 = \text{H}_2\text{C}_4\text{H}_4\text{O}_6 + \text{CaSO}_4$ . It is in colorless, translucent,

FIG. 462.



Tartaric acid crystal.

monoclinic prisms, or white powder, odorless, acid taste, permanent, soluble in 0.71 part water, 1.67 alcohol, 250 ether, high heat decomposes it with burning-sugar odor, ash 0.05 p. c. Its graphic formula represents hydrogen in hydroxyl replaceable by alcohol radical, not by metals, and hydrogen in carboxyl replaceable by metals alone; contains 99.5 p. c. of pure acid. *Test*: 1. Solution potassium acetate (1 in 3) gives white precipitate, soluble in solutions of alkalis and mineral acids, insoluble in acetic acid. *Assay*: To neutralize 3.73 Gm. should require 49.8 Cc. normal potassium hydroxide

V. S. (each Cc. corresponding to 2 p. c. of pure acid), using phenolphthalein T. S. indicator. *Impurities*: Heavy metals, calcium, sulphuric and oxalic acids. Dose, gr. 5–30 (.3–2 Gm.).

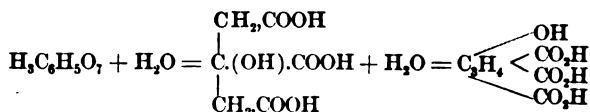
PREPARATIONS.—1. *Effervescent Salts*, 25.2 p. c., etc.

PROPERTIES AND USES.—Owing to its greater cheapness is much used in place of citric acid in making lemonade, effervescing drinks, powders, etc. When mixed with sugar, mucilage, aromatics, etc., it serves to moisten the throat in pharyngitis, pulmonary catarrh, to dissolve false membranes of diphtheria, correct feter of feet, etc.

### 3. TRIBASIC FATTY ACIDS.

(These acids have 3 hydrogen atoms replaceable by metals.)

**Acidum Citricum.** Citric Acid.—(Syn., Acidum Citri—Limonis—Limonum—Limonorum; Fr. Acide (du Citron) citrique; Ger. Acidum citricum, Citronensäure, Citronsäure.)



**Manufacture:** This tribasic organic acid occurs in juices of plants, especially in their fruit, as strawberry, raspberry, cherry, currant, lemon, lime, gooseberry, whortleberry, cranberry, tamarind, tomato, etc.; it is usually prepared from the juice of limes or lemons by first clarifying by ebullition, then neutralizing with chalk, the resulting calcium citrate is washed with boiling water, in which it is sparingly soluble, decomposed with diluted sulphuric acid; strain out calcium sulphate, concentrate, allow to crystallize in wooden vats lined with lead: (1)  $2\text{H}_3\text{C}_6\text{H}_5\text{O}_7 + 3\text{CaCO}_3 = \text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 + 3\text{CO}_2 + 3\text{H}_2\text{O}$ . (2)  $\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 + 3\text{H}_2\text{SO}_4 = 2\text{H}_3\text{C}_6\text{H}_5\text{O}_7 + 3\text{CaSO}_4$ . It is in colorless, translucent, right-rhombic prisms, odorless, agreeable acid taste, efflorescent in warm air, deliquescent in moist air, soluble in 0.54 part water, 1.08 alcohol, 18 ether, loses water of crystallization, becomes anhydrous, melts; contains 99.5 p. c. of pure acid. **Tests:** 1. Decomposes upon ignition without odor of burning sugar (dif. from tartaric acid), leaving residue 0.05 p. c. 2. Aqueous solution remains clear with calcium hydroxide T. S., upon boiling precipitates calcium citrate, which redissolves on cooling. **Assay:** Dissolve 5 Gm. in water q. s. 100 Cc., of this 34.75 Cc. should require 24.87 Cc. normal potassium hydroxide V. S. for neutralization (each Cc. of V. S. corresponding to 4 p. c. of pure acid), using phenolphthalein T. S. indicator. **Impurities:** Heavy metals, iron, calcium, oxalic, sulphuric, tartaric acids. **Dose, gr.** 5–30 (.3–2 Gm.).

FIG. 463.



Citric acid crystal.

**PREPARATION.**—1. *Syrupus Acidi Citrici*. Syrup of Citric Acid. (Syn., Fr. Sirop (d'Acide citrique) de Limon; Ger. Citronsäuresirup.)

**Manufacture:** 1 p. c. Dissolve citric acid 1 Gm. in distilled water 1 Cc., add syrup 50 Cc., then tincture of fresh lemon-peel 1 Cc., and syrup q. s. 100 Cc. **Dose, 3j–4 (4–15 Cc.).**

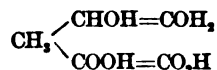
**Prep.:** 1. *Liquor Magnesii Citratis*, 60 Cc.

2. *Effervescent Salts*, 16.2 p. c., etc.

**PROPERTIES AND USES.**—Irritant, antiscorbutic, stimulant, diuretic, refrigerant; rheumatism, hemorrhage, jaundice, scurvy, fevers, antidote to alkaline and narcotic poisons, good locally for diphtheritic angina, gangrenous sore mouth, jaundice, pruritus, cancerous tumors, reduces obesity, prolonged usage emaciates.

**Acidum Lacticum. Lactic Acid,  $\text{HC}_3\text{H}_5\text{O}_3$ .**—(Syn., Isolactic, Ethyldene-lactic, or Oxypropionic Acid; Fr. Acide lactique; Ger. Acidum lacticum, Milchsäure.) A liquid organic acid, composed of 75 p. c. by weight of absolute lactic acid,  $\text{HC}_3\text{H}_5\text{O}_3$ , and 25 p. c. of water. This is the second member of a group of monobasic diatomic acids which contain two hydroxyl groups, the hydrogen in one (the upper,

$\text{COH}_2$ ) being replaceable by alcohol, that of the other (lower,  $\text{CO}_2\text{H}$ ) by metals :



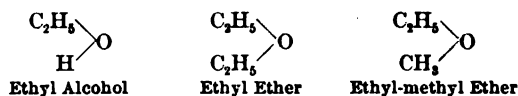
**Manufacture:** Lactic acid occurs in gastric juice, urine, intestinal juices, many plant-juices, sour milk, sour cabbage, and is produced from sugar by the special lactic ferment (*Bacterium lac'tis*). Allow milk sugar, or inverted sugar, milk, or cheese and water to undergo fermentation, at  $25\text{--}35^\circ \text{C}$ . ( $77\text{--}95^\circ \text{F}$ .), neutralize acid as fast as formed with chalk or zinc oxide, as butyric acid will be produced if much free lactic acid present, recrystallize resulting calcium or zinc lactate, decompose with sulphuric acid or hydrogen sulphide, evaporate filtrate. It is a colorless, syrupy liquid, odorless, acid taste, hygroscopic; sp. gr. 1.206, miscible with water, alcohol, ether. **Test:** 1. Add an equal volume of sulphuric acid + some potassium permanganate, heat gently, get odor of aldehyde; does not vaporize below  $160^\circ \text{C}$ . ( $320^\circ \text{F}$ .). **Assay:** To 5 Gm. add water q. s. 50 Cc., of this 44.7 Cc. should require for neutralization 35.5 Cc. normal potassium hydroxide V.S. (each Cc. of V.S. corresponding to 2 p. c. of absolute acid), using phenolphthalein T.S. indicator. **Impurities:** Heavy metals, chloride, sulphate, sarcolactic acid, glycerin, organic substances, butyric and other fatty acids, sugars. Dose, 3ss–2 (2–8 Cc.), in lemonade. If by enema, the acid should be neutralized by sodium bicarbonate.

**PREPARATION.**—1. *Syrupus Calcii Lactophosphatis*, 6 p. c.

**PROPERTIES AND USES.**—Caustic, large doses hypnotic, stomachic. Lactic acid has gained its popularity from the fact of its being one of the constituents of the gastric juice, etc. Given in dyspepsia, phosphatic deposits, tuberculous diarrhoea, green infantile diarrhoea, diabetes, rheumatism, otitis, ulcers of nasal fossæ, diphtheria, croup, insomnia, caustic to fungous caries, lupus, epithelioma, ulcers, tuberculous ulcers, laryngeal and pharyngeal affections (morbid growths, etc.).

## V. Ethers.

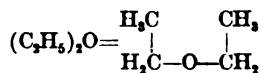
These are formed from alcohols by replacing the hydrogen of hydroxyl by the same or other alcohol radicals, thus :



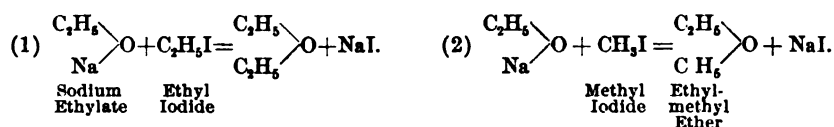
Ethers are the oxides of organic radicals or residues, and these latter may be alike or different, thus giving simple or mixed ethers.

**Æther.** **Æther.**—(Syn., Æther Fortior, Æther Sulphuricus, Hydric Ether, Naphtha Vitrioli, Hydrate of Ethylen, Oxide of Ethyl; Fr. Ether hydrique—vinique—sulfurique; Ger. Aether, Schwefeläther.)

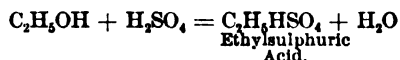
A liquid composed of 96 p. c. by weight of absolute ether or ethyl oxide,  $(C_2H_5)_2O$ , and 4 p. c. of alcohol containing a little water.



**Manufacture:** 1. By action of chloride or iodide of hydrocarbon residue upon an alcohol in which the hydrogen of hydroxyl has been replaced by a metal:



2. By action of sulphuric acid on alcohols, whereby 1 molecule of water is abstracted from 2 molecules of alcohol; this is the general process, and consists in distilling together alcohol and sulphuric acid at about  $130^\circ C.$  ( $266^\circ F.$ ), passing the vapors through two purifiers, one of cast iron containing solution potassium hydroxide to remove water and other impurities, the other of block-tin containing pebble-stones to recondense alcoholic and other vapors of higher boiling-points than ether.



This ethylsulphuric acid acts upon another alcohol molecule, giving ether— $C_2H_5HSO_4 + C_2H_5OH = (C_2H_5)_2O + H_2SO_4$ . This process, in theory, is continuous, the  $H_2SO_4$  last formed again acting on fresh alcohol as it is supplied; in practice this is not true, as the  $H_2SO_4$  becomes, after a time, so weak from the accumulated water, which never entirely goes over, that it will not act upon the alcohol. Each gallon (4 L.) of alcohol yields about 4 pounds (2 Kg.) of ether. **Impurities:** Water, alcohol, aldehyde, foreign odor, residue, mostly removed by the purifiers. It is a transparent, colorless, mobile liquid, characteristic odor, burning, sweetish taste, sp. gr. 0.716, soluble in 10 volumes water, miscible with alcohol, chloroform, petroleum benzin, benzene, fixed and volatile oils, highly volatile and inflammable, boils at  $35.5^\circ C.$  ( $96^\circ F.$ ). Should be kept cool, remote from lights or fire, in partially filled, well-stoppered containers, preferably tin cans. Dose,  $\mathfrak{m}\nu-60$  (.3–4 Cc.).

**PREPARATIONS.**—1. *Spiritus Ætheris*. Spirit of Ether. (Syn., Liquor Anodynus Mineralis Hoffmanni; Fr. *Æther Sulfuricus Alcoholisatus*, *Éther hydrique* (sulfurique) alcoolisé, Liqueur anodine d'Hoffmann; Ger. *Spiritus æthereus*, *Ætherweingeist*, Hoffmann'sche Tropfen.)

**Manufacture:** Mix ether 32.5 Cc., alcohol 67.5 Cc. Dose,  $\mathfrak{m}\text{xv}-60$  (1–4 Cc.).

2. *Oleum Æthereum*. Ethereal Oil. (Syn., *Oleum Vini*, Heavy

Oil of Wine; Fr. Huile (volatile étherée) d'Ether; Ger. Schweres Weinöl.) A volatile liquid consisting of equal volumes of heavy oil of wine and ether.

*Manufacture:* Add sulphuric acid 1,000 Cc. slowly to alcohol 1,000 Cc., in closed flask, let stand until clear (24 hours), distil mixture on sand-bath at 150–160° C. (302–320° F.), until oily drops cease to come over, or black froth rises; separate yellow ethereal liquid from the distillate, expose 24 hours, filter off aqueous portion, wash oil left on filter with cold distilled water 25 Cc., when drained add to the oil an equal volume of ether. It is a transparent, nearly colorless, volatile liquid, peculiar, aromatic, ethereal odor, pungent, refreshing, bitter taste, sp. gr. 0.905. Should be kept cool, in small, glass-stoppered vials.

3. *Spiritus Ætheris Compositus.* Compound Spirit of Ether. (Syn., Hoffmann's Anodyne; Fr. Liqueur Nervine de Bang; Ger. Zusammengesetzter Ätherweingeist.)

*Manufacture:* Mix ether 32.5 Cc., alcohol 65 Cc., ethereal oil 2.5 Cc. Dose,  $\mathfrak{m}\mathfrak{v}$ –60 (.3–4 Cc.).

**PROPERTIES.**—Internally—acts like chloroform or alcohol, cardiac stimulant, anæsthetic, narcotic, carminative, antispasmodic. Externally—irritant, local anæsthetic, stimulant, refrigerant. The heart, vasomotor and respiratory centres are paralyzed much less easily by ether than by chloroform; ether, however, is a more intense renal and bronchial irritant, also more likely to induce vomiting and a more protracted stage of stimulation, hence more struggling.

**USES.**—Internally—nausea, dyspepsia, flatulent and biliary colic, neuralgia of the gums, earache, fainting, cardiac failure or palpitation, asthma; here more rapid than chloroform in action, hence for these cases it is better. Ether is inhaled to blunt sensibility in surgical operations, to relax muscles in dislocations, strangulated hernia, neuralgia, biliary and renal colic, dysmenorrhœa, tetanus, spasms, asthma, chronic bronchitis, labor, extracting teeth, headache, vomiting of pregnancy, hysteria, tænia, biliary calculi, whooping-cough, spasmodic croup, delirium tremens, mania, lumbago, sciatica, collapse in opium- and hydrated-chloral-poisoning, convulsions. Should inhale ether slowly through the nostrils, on empty stomach, and watch the pulse closely. If beats become slow, feeble, or quick, the sponge should at once be removed; best inhaled from sponge fixed in a paper cone having the larger end over the face and the smaller end cut off to admit a small amount (30 p. c.) of air. It requires about  $\mathfrak{z}\mathfrak{i}\mathfrak{j}$  (60 Cc.) and 5–15 minutes to produce insensibility. On recovery have more nausea and vomiting than follows chloroform, which may be checked by sodium bromide gr. 15 (1 Gm.); should not use it at night, and never near flame or fire. One death occurs from every 16,000 inhalations. Externally—headache, toothache, earache, neuralgia, deafness, photophobia, hernia, hiccough, malignant pustule, carbuncle, tonsillitis. Also may freeze by ether part to be operated upon, and thus deaden pain. The two spirits are useful in sleeplessness, restlessness, nervous disturbance, hysteria, flatulent and uterine colic.

*Incompatibles*: Arterial sedatives, strychnine, picrotoxin.

*Synergists*: Arterial and cerebral stimulants, chloroform, alcohol, etc.

**Æther Aceticus.** Acetic Ether,  $C_2H_5C_2H_3O_2 = CH_3COOC_2H_5$ .—(Syn., Ethyl Acetate, Naphtha Aceti; Fr. Ether acétique, Acétate d'Éthyle, Naphte acétique; Ger. Aether aceticus, Essigäther, Essignaphtha.) A liquid composed of 90 p. c. by weight of ethyl acetate,  $C_2H_5C_2H_3O_2$ , and 10 p. c. of alcohol containing a little water.

*Manufacture*: Set aside for a day or two in a well-closed flask 63 Gm. alcohol + 111 Gm. sulphuric acid, in order that ethylsulphuric acid may be formed, add this to a retort containing 82 Gm. powdered anhydrous sodium acetate; heat retort on water-bath, condense vapors in a well-cooled receiver— $C_2H_5OH + H_2SO_4 = C_2H_5HSO_4 + H_2O$ ;  $C_2H_5HSO_4 + NaC_2H_3O_2 = C_2H_5C_2H_3O_2 + NaHSO_4$ . To purify from acetic acid, alcohol and water, shake with one-third volume of aqueous solution containing 20 p. c. sodium chloride and 2 p. c. sodium carbonate, carefully decant ethereal layer; to remove water, shake with freshly ignited potassium carbonate, then distil. It is a transparent, colorless liquid, fragrant, refreshing acetous odor, peculiar acetous, burning taste, sp. gr. 0.885, boils at 72° C. (162° F.), soluble in 7 parts water, miscible with alcohol, ether, fixed and volatile oils, volatile, inflammable. *Impurities*: Butylic and amylic derivatives, alcohol, water, carbonizable organic substance. Should be kept cool, dark, remote from lights or fire, in well-stoppered bottles. Dose, ℥xv–30 (1–2 Cc.), well diluted.

**PROPERTIES AND USES.**—Acts like ether, as stimulant, antispasmodic, carminative, but has a more pleasant taste; syncope, nervous agitation, colic, flatulence; may be inhaled for laryngeal and bronchial irritation, nervous cough. Externally—same as ether.

**Spiritus Ætheris Nitrosi.** Spirit of Nitrous Ether,  $C_2H_5NO_2$ .—(Syn., Spiritus Nitri Dulcis, Sweet Spirit of Nitre, Ethyl Nitrite, Spiritus Nitrico-Æthereus; Fr. Éther azoteux alcoolisé, Liqueur anodine nitreuse; Ger. Spiritus Aetheris nitrosi, Versüsster Salpetergeist.) An alcoholic solution of ethyl nitrite,  $C_2H_5NO_2$ , yielding when freshly prepared and tested not less than 4 p. c. of ethyl nitrite.

*Manufacture*: Mix sulphuric acid 40 Cc., water 120 Cc., cool, add diluted alcohol 170 Cc., pour into 1,000 Cc. flask, surround with ice and water; dissolve sodium nitrite 100 Gm. in water 280 Cc., filter, pour into separatory funnel, let slowly drop into flask containing acid mixture, when reaction complete discard aqueous liquid, wash separated ethyl nitrite with ice-cold water 20 Cc., then with ice-cold water 15 Cc. containing monohydrated sodium carbonate .6 Gm., separate ethyl nitrite from aqueous liquid, shake with potassium carbonate 3 Gm., cool, pour ethyl nitrite into alcohol 500 Gm., ascertain weight of the ethyl nitrite by noting increased weight of tared bottle and contents, add alcohol q. s. to make mixture weigh 22 times weight of ethyl

nitrite added. It is a clear, mobile, volatile, inflammable liquid, pale yellowish, or faintly greenish-yellow tint, fragrant, ethereal, pungent odor free from acidity, sharp, burning taste, sp. gr. 0.823, neutral, but acid by age. *Tests*: 1. Should not effervesce with potassium carbonate crystal; at 65° C. (149° F.) should boil upon adding pieces of broken glass. 2. Mix 10 Cc. with 5 Cc. potassium hydroxide T. S., previously diluted with 5 Cc. water, gives yellow color which should not be brown in 12 hours (lim. of aldehyde). *Assay*: Weigh 30 Gm., having been previously shaken with 0.5 Gm. potassium bicarbonate, in tared 100 Cc. measuring flask, add alcohol q. s. 100 Cc.; introduce 10 Cc. of this into nitrometer + 10 Cc. potassium iodide T. S., + 10 Cc. normal sulphuric acid V. S.; when volume of gas constant (30–60 minutes), note volume in Cc., multiply by 0.307, divide product by original weight, the quotient = p. c. of ethyl nitrite, which should not be less than 4 p. c. *Impurities*: Aldehyde, acetic acid. Should be kept cool, remote from lights or fire, in small, well-stoppered, dark amber-colored vials. Dose, ʒss-2 (2–8 Cc.).

*PREPARATIONS*.—1. *Mistura Glycyrrhizæ Composita*, 3 p. c.

*Unoff. Prep.*: *Liquor Ethyl Nitritis* (Br.), ethyl nitrite 3 p. c. (+ alcohol 95, glycerin 5), dose, ℥xx-60 (1.3–4 Cc.).

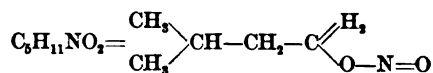
*PROPERTIES*.—Diffusible stimulant, stomachic, carminative, diaphoretic, diuretic, anæsthetic, antispasmodic, antipyretic.

*USES*.—Febrile condition to promote sweating, strangury, urinary and kidney affections, flatulence, nausea, nervous agitation, coughing, headache, chronic bronchitis, fevers, in ordinary cold, chronic Bright's, cardiac, and pulmonary diseases.

*Incompatibles*: Potassium iodide, ferric sulphate, mucilage of acacia, tincture of guaiac(um), antipyrine, emulsions, tannin, gallic acid.

*Synergists*: Diaphoretics, diuretics, antispasmodics, potassium citrate, tincture of aconite, etc.

**Amyl Nitris. Amyl Nitrite.**—(Syn., Amyl Æther Nitrosus, Amylonitrous Ether; Fr. Azotite d'Amyl, Ether amylazoteux; Ger. Amylium Nitrosum, Amylnitrit.) A liquid containing 80 p. c. of amyl (chiefly isoamyl) nitrite,  $C_5H_{11}NO_2$ .



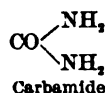
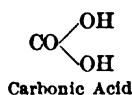
*Manufacture*: Distil sodium nitrite, amyl alcohol, and diluted sulphuric acid, collecting that vaporizing at 95–100° C. (203–212° F.); wash distillate with solution sodium carbonate (to remove acid), dehydrate with fused calcium chloride, redistil below 100° C. (212° F.).— $2C_5H_{11}OH + 2NaNO_2 + H_2SO_4 = 2C_5H_{11}NO_2 + Na_2SO_4 + 2H_2O$ ; or distil equal volumes pure amyl alcohol and nitric acid— $C_5H_{11}OH + HNO_3$  (deoxidizing into  $HNO_2$ ) =  $C_5H_{11}NO_2 + H_2O$ . It is a clear, yellowish liquid, peculiar, ethereal, fruity odor, pungent, aromatic taste, insoluble in water, miscible with alcohol, ether, very volatile,

inflammable, sp. gr. 0.870, boils at 99° C. (210° F.). *Assay*: Shake 3 Cc., with 0.5 Gm. potassium bicarbonate, decant to 100 Cc. measuring flask, weigh, add alcohol q. s. 100 Cc.; introduce 10 Cc. into a nitrometer, + 10 Cc. potassium iodide T. S., + 10 Cc. normal sulphuric acid V. S.; when volume gas constant (30–60 minutes) note volume collected, multiply this in Cc. by 4.8, divide product by original weight, the quotient = p. c. of amyl nitrite in liquid. *Impurities*: Free acid, aldehyde, water. Should be kept cool, dark, in hermetically sealed glass bulbs, or in glass-stoppered, dark amber-colored bottles. Dose, Mj–3 (.06–.2 Cc.), cautiously inhaled from a handkerchief in which a glass tear (capsule) containing the amyl nitrite has been crushed. Internally give Mss–1 (.03–.06 Cc.), dissolved in alcohol.

**PROPERTIES.**—Irritant, sedative, depressant, antispasmodic, anodyne, diuretic. Causes flushed face, rapid and violent heart-beats, throbbing head, headache, giddiness, dilated pupils, increased respiration.

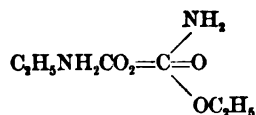
**USES.**—Relax spasms, angina pectoris, functional or slight organic heart disease, asthma, convulsions following labor, spasmodic dysmenorrhœa, tetanus, hysterical convulsions, epileptic paroxysms, neuralgia, headache, whooping-cough, hiccough, vomiting of pregnancy, syncope, faintness, hepatic and renal colic, spasm of the glottis, vertigo, pneumonia, intermittent fever, night-sweats, chorea, infantile convulsions, hydrophobia, chordee, exophthalmic goitre, chloroform syncope, sea-sickness, strychnine-, hydrated chloral-, cocaine-, and severe carbonic-acid poisoning, insomnia from opium-habit. Externally—as an anodyne in headache, toothache, earache, neuralgia, dysmenorrhœa; fœtor of gangrene, secretions, and exudations, modified by its solution. Should not be used where there is profuse hemorrhage, or when there is serious organic heart or brain disease (degeneration of arteries).

### 3. UREA DERIVATIVES.



Urea (carbamide) is carbonic acid with its 2 hydroxyls replaced by 2 ammonia residues,  $\text{NH}_2$ , as shown above.

**Æthylis Carbamas.** Ethyl Carbamate,  $\text{C}_3\text{H}_7\text{NO}_2$ .—(Syn., Urethanim, Urethane, Ethyl Urethane; Fr. Uréthane; Ger. Carbaminsaure Äthylester.) An ester of carbamic acid,  $\text{CO}(\text{OC}_2\text{H}_5)\text{NH}_2$ , obtained by the reaction of ethyl alcohol upon urea (carbamide) or one of its salts.



**Manufacture:** Heat together urea nitrate and ethyl alcohol for several hours in a steam digester at 120–130° C. (248–266° F.). The



resulting crystalline mass is dissolved in water, shaken out with ether, after recovering ether residue is distilled and crystallized from water. It is in colorless, columnar crystals or scales, odorless, cooling saline taste, soluble in 1 part water, 0.6 alcohol, 1 ether, 1.3 chloroform, 3 glycerin, melts at  $50^{\circ}\text{C}$ . ( $122^{\circ}\text{F}$ .), decomposes at higher temperature, no residue. *Tests*: 1. Add 1 Gm. to 5 Gm. sulphuric acid, heat gently, get decomposition, with evolution of carbon dioxide, while alcohol and acid ammonium sulphate remain in solution; heated with potassium hydroxide T. S. gives off ammonia gas. 2. Dissolve 6 Gm. in 6 Cc. water, separate portions should not give white precipitates with either nitric acid, mercuric nitrate T. S., or oxalic acid T. S. (dis. from and abs. of urea or carbamide). Should be kept in well-stoppered bottles. Dose, gr. 10–40 (.6–2.6 Gm.).

**PROPERTIES AND USES.**—Hypnotic, without unpleasant after-effects; resembles paraldehyde in action; overdoses depress spinal cord, heart, and respiration, death due to asphyxia; used in nervous or functional insomnia, or that due to mental or physical depression, chronic alcoholism, insanity.

## II. AROMATIC SERIES.

As previously stated, all organic compounds are either derivatives of methane,  $\text{CH}_4$  (fatty series), or of benzene,  $\text{C}_6\text{H}_6$  (aromatic series), and while these two parental compounds are strictly hydrocarbons, they as well as their derivatives are thoroughly distinctive, as they cannot in any sense be substituted for or converted into one another. The members of the fatty series, in a degree, are products that might be used as animal food; those of the aromatic series have not this power, being simply aromatics, antiseptics, stimulants. Many compounds of this latter series are obtained directly from the vegetable kingdom, while a great number result indirectly therefrom by destructive distillation. When coal-tar is distilled and the distillate caught in water, it separates into two layers—*light oil* floating on top of the water, *heavy oil* sinking below the water: from the former come benzene, etc.; from the latter, phenol (carbolic acid), etc.

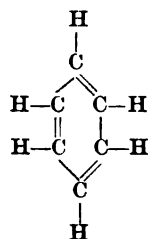
**Benzenum.** Benzene,  $\text{C}_6\text{H}_6$ .—(Syn., Benzol, Benzole, Phenyl Hydride, Coal Naphtha; Fr. Benzene; Ger. Benzen.) A mixture of homologous hydrocarbons, chiefly benzene,  $\text{C}_6\text{H}_6$ , 70 p. c. + toluene,  $\text{C}_6\text{H}_5\text{CH}_3$ , 20–30 p. c.

*Manufacture*: Distil coal-tar, when water and ammonia pass over along with 8–10 p. c. of a brown liquid, light oil, later the dead oil is obtained containing aniline, quinoline, naphthalene, phenol (carbolic acid), etc. The light oil contains benzene, toluene, xylene, isocumene, these being separated by fractional distillation, benzene coming over at  $80^{\circ}\text{C}$ . ( $176^{\circ}\text{F}$ .), toluene at  $110^{\circ}\text{C}$ . ( $230^{\circ}\text{F}$ .), which may be purified by exposing to a low temperature and expressing the portion remaining liquid. It is a thin, colorless, very inflammable liquid, coal-gas odor,

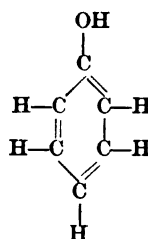
sp. gr. 0.884, congeals at 0° C. (32° F.), soluble in ether, chloroform, acetone, 4 parts alcohol, with nitric acid readily converted into nitrobenzene. *Impurities*: Acetylene, thiophene, carbon disulphide, toluene, xylene, etc.

**PROPERTIES AND USES.**—Antispasmodic, anticephalalgic, antizymotic, germicide, poisonous (causing uncertain gait, mental disturbance, wandering delirium, vertigo, loss of sexual power, epileptic convulsions, deep sleep). Used in whooping-cough, influenza; solvent for fats, volatile oils, resins, caoutchouc, sulphur, phosphorus, iodine, alkaloids (quinine, etc.). Its principal use, however, is in the manufacture of aniline, and therefrom the many important coal-tar products. Dose,  $\text{Mx}$ –30 (.6–2 Cc.), emulsion, on sugar, in capsule; locally mixed with 9 parts soapsuds.

**Phenol.** Phenol,  $\text{C}_6\text{H}_5\text{OH}$ .—(L. fr. Gr. *φαίνειν*, to show, or *φοῖν* (*ἰς*), purple-red + *ol(eum)*.) (Syn., Acidum Carbolicum, U. S. P. 1890, Carbolic Acid, Acidum Phenicum—Phenylicum (Crystallizatum), Phenic—Phenylic Acid, Phenylic Alcohol, Benzophenol; Fr. Acide carbolique—phénique, Hydrate de Phényle; Ger. Karbolsäure, Phenylsäure, Phenylalkohol.) Hydroxybenzene, obtained either from coal-tar by fractional distillation and subsequent purification, or made synthetically; it is the alcohol of the hydrocarbon benzene, and according to the number of hydrogen atoms replaced by the hydroxyl, OH, do we have mon-, di-, tri-atomic, etc., phenols or alcohols. This hydroxyl here is acid, whereas that in methane alcohols is basic; these phenols or phenol alcohols differ from common alcohols in not yielding aldehydes or acids by oxidation and in having hydroxyl (OH) that is acid.



Benzene.



Phenol (Carbolic Acid).

**Manufacture:** Phenol occurs in castoreum, urine and in products of dry distillation of bones, resins and wood, especially coal; that portion of coal-tar coming over at 100–250° C. (212–482° F.) is known as *light oil*, sp. gr. 0.940–0.990, and contains phenol 4–10 p. c. This fraction is agitated with a 10 p. c. solution sodium hydroxide (stronger solution undesirable, as it would dissolve also naphthalene, etc.), and upon standing separates into two layers—lower, being a solution of sodium-phenol,—upper, consisting of the extracted oil; draw off and treat lower layer with hydrochloric or sulphuric acid sufficient for exact decomposition; the impure phenol thus liberated rises to the

surface as an oily layer, which is removed and washed by agitation with concentrated solution sodium chloride, freed from water by calcium chloride, then distilled at 180–190° C. (356–374° F.); expose distillate to cold, when phenol congeals in crystalline mass, which freed from adhering liquid is again distilled at 185° C. (365° F.) and crystallized. Sometimes before final distillation it is treated with potassium dichromate and sulphuric acid, and to get colorless loose crystals may recrystallize from boiling petroleum benzin. Phenol may also be obtained from the *heavy oil*, collecting that portion coming over at 160–220° C. (320–428° F.), then treating distillate as above. Phenol may be obtained synthetically from benzene (benzol) by treating with sulphuric acid, heating— $C_6H_6 + H_2SO_4 = C_6H_5SO_3OH + H_2O$ ; the resulting benzene-sulphonic acid is neutralized with potassium carbonate, yielding potassium benzene-sulphonate, and this compound fused with excess of potassium hydroxide— $2(C_6H_5SO_3OK) + 4KOH = 2H_2O + 2K_2SO_3 + 2C_6H_5OK$ , the latter, potassium-phenol, is treated with solution hydrochloric acid, which liberates phenol, to be purified by distillation— $C_6H_5OK + HCl = C_6H_5OH + KCl$ . This process has the advantage of yielding phenol free from cresol, xylene, etc., as benzene can be used of absolute purity. It is in colorless, interlaced, or separate needle-shaped crystals, or white, crystalline mass, sometimes acquiring reddish tint, characteristic, aromatic odor, copiously diluted with water sweetish taste, slightly burning after-taste, when undiluted cauterizes and whitens skin and mucous membrane, soluble in alcohol, ether, chloroform, benzene, carbon disulphide, glycerin, fixed and volatile oils, 19.6 parts water, liquefied by gentle heat or 8 p. c. water, boils at 188° C. (370° F.), pure phenol at 178° C. (352° F.), vapor inflammable, no residue; contains at least 96 p. c. of absolute phenol. *Tests*: 1. Aqueous solution 10 Cc. (1 in 100) — 1 drop ferric chloride T. S. gives permanent violet-blue color. 2. 1 volume liquefied phenol (with water 8 p. c.) + 1 volume glycerin gives clear liquid, not turbid with 3 volumes water (abs. of creosote, cresol); coagulates albumin, collodion. *Assay*: Dissolve 1.556 Gm. in water q. s. 1,000 Cc.; to 25 Cc. (containing 0.0389 Gm.) add 30 Cc.  $\frac{N}{10}$  bromine V. S. + 5 Cc. hydrochloric acid, insert stopper, shake repeatedly for half-hour, introduce quickly 5 Cc. aqueous solution potassium iodide (1 in 5), allowing no bromine vapor to escape, shake, add 1 Cc. chloroform, shake, add from burette  $\frac{N}{10}$  sodium thio-sulphate V. S. until iodine tint just discharged, note Cc. of V. S. consumed (which should not exceed 6 Cc.); subtract number Cc. of V. S. used from 30 (number Cc. of bromine V. S. originally added), multiply remainder by 4 = p. c. of absolute phenol. *Impurities*: Creosote, cresol, etc. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

*PREPARATIONS*.—1. *Phenol Liquefactum*. Liquefied Phenol. (Syn., Acidum Carbolium Liquefactum, Liquefied Carbohc Acid; Ger. Verflüssigte Karbolsäure.)

*Manufacture*: Liquefy phenol, a convenient quantity, by placing unstoppered container in water-bath, apply heat gradually until crystals

melted, transfer liquid to tared vessel, weigh; for each 9 Gm. phenol add 1 Gm. distilled water, mix thoroughly. It is a colorless liquid, developing slight reddish tint by age, characteristic, aromatic odor, sp. gr. 1.065, miscible with alcohol, ether, glycerin, 12 parts water, boils at 115–188° C. (239–370° F.), crystallizes at 13.5° C. (56.3° F.); contains 86.4 p. c., by weight, of absolute phenol, and about 13.6 p. c. of water. *Tests*: 1. 1 part acquires permanent cloudiness when mixed respectively with 2 parts chloroform, 1.5 benzene, 2.5 carbon disulphide, 2 oil of turpentine, 2.5 olive oil; otherwise same as for phenol. Should be kept in well-stoppered, dark amber-colored bottles. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

2. *Glyceritum Phenolis*. Glycerite of Phenol. (Syn., *Glyceritum Acidi Carbolici*, U. S. P. 1890; Br. Glycerin of Phenol; Fr. Glycérôle (Glycéré) d'Acide phénique, Glycérine phénique; Ger. Phenol (Phenyl)-glycerit.)

*Manufacture*: 20 p. c. Stir together until dissolved liquefied phenol 20 Gm. and glycerin 80 Gm. Dose, Mij–5 (.13–.3 Cc.).

3. *Unguentum Phenolis*. Ointment of Phenol. (Syn., Br. Phenol Ointment; Fr. Pommade (d'Acide) phénique; Ger. Phenolsalbe.)

*Manufacture*: 3 p. c. To melted white petrolatum 97 Gm. add phenol 3 Gm., stir until it begins to congeal.

*Unoff. Preps.*: *Suppositoria Acidi Carbolici* (Br.), each contains 1 gr. (.06 Gm.). *Trochiscus Acidi Carbolici* (Br.), each contains 1 gr. (.06 Gm.).

**PROPERTIES.**—Internally—sedative, antifermentative, antipyretic, irritant, poisonous. Externally—antizymotic, antiseptic, disinfectant, deodorant, anæsthetic, irritant caustic. Rapidly destroys animal and vegetable organized ferments, also those organisms causing septic diseases, thereby preventing the formation of their decomposition-products. In the stomach is converted into a sulphophenolate, but may circulate as an alkaline phenolate. Diminishes the production of heat and increases its dissipation, renders urine dark.

**USES.**—Internally—vomiting, diarrhœa, flatulent dyspepsia, typhoid and intermittent fevers, scarlatina. Externally—in spray, ulcers, gangrene, phthisis, chronic bronchitis, whooping-cough, diphtheria, erysipelas, pain of burns, polypi, venereal abscesses, boils, carbuncles, hemorrhoids, varicose veins, goitre, hydrocele, sore nipples, granular ophthalmia, otorrhœa, earache, surgical operations, freckles, acne, prurigo, ringworm, warts, bee-stings, sore throat, toothache, rheumatism, bunions, diabetes.

*Poisoning*: Have burning sensation, collapse, cold, clammy skin, weak pulse, feeble, shallow breathing, urine dark green, white eschars from lips, mouth, etc., vomiting, purging, dizziness, low temperature, contracted pupils, insensibility, comatose, death. Give quick emetic—apomorphine hypodermically—or wash out stomach with alcohol  $\mathfrak{z}$ ij–4 (60–120 Cc.) diluted with an equal quantity of water, remove at once by emetic or tube, repeat this every 5–10 minutes for 4 to 8 times; may follow with magnesium or sodium sulphate ( $\mathfrak{z}$ ij; 30 Gm. + water  $\mathfrak{z}$ viii; 240 Cc.), then stimulants, ether, brandy, atropine and strychnine.

nine hypodermically, digitalis, coffee, demulcent drinks (no oils or glycerin), opium, apply hot-water bottle, bag, or blankets, etc.

*Incompatibles*: Alcohol, bromine, soapsuds, albumin, metallic salts, antipyrine, collodion, alkalies, lime, soluble sulphates, atropine.

*Synergists*: Antiseptics, motor depressants.

**Creosotum.** Creosote,  $C_7H_8O_2 + C_8H_{10}O_2$ .—(Gr. *κρέας*, flesh, + *σώζεν*, to preserve—i. e., its preserving properties.) (Syn., Fr. Créosote; Ger. Kreosotum, Kreosot.) A mixture of phenols and phenol derivatives, chiefly guaiacol,  $C_7H_8O_2$ , and creosol,  $C_8H_{10}O_2$ , obtained during the distillation of wood-tar, preferably of that derived from the beech (*Fagus sylvatica* or *F. ferruginea*, Fagaceæ).

*Manufacture*: The wood-tar is distilled until one-half has passed over, the distillate separating into a light and a heavy oily layer, with an intervening aqueous acid stratum; the light oil contains eupion, etc.; to the heavy oily layer add strong  $Na_2CO_3$  solution (to remove acid constituents) and then distill the separated oily liquid, that portion of the distillate being collected which is heavier than water; this distillate is treated with KOH solution, sp. gr. 1.12, whereby the creosote is dissolved and eupion separated, now add  $H_2SO_4$ , wash well the precipitated creosote and distil at 200–220° C. (392–428° F.); treatment with potassium hydroxide and sulphuric acid is repeated until potassium creosote solution no longer turns brown upon heating in the air. Creosote can be obtained from pyroligneous acid by saturating with sodium sulphate at 70° C. (158° F.), skimming off supernatant oily layer, distilling it and treating distillate with sodium carbonate. It varies in composition according to method and wood used, and consists chiefly of acid methylic ethers of catechol (guaiacol) and its homologues—guaiacol, creosol, phlorol (xylenol),  $C_6H_{10}O$ , methyl-creosol,  $C_6H_{12}O_2$ , methyl-guaiacol,  $C_8H_{10}O_2$ . It is almost colorless, yellowish (not pinkish), highly refractive, oily liquid, penetrating, smoky odor, burning, caustic taste, should not become brown on exposure to light, sp. gr. 1.072, soluble in alcohol, ether, chloroform, acetic acid, fixed and volatile oils, 140 parts water (turbid), with 120 hot water forms clear liquid, but turbid upon cooling from separation of minute oily drops (dis. from and abs. of phenol and coal-tar creosote; filtrate yields reddish-brown precipitate with bromine T. S. (dis. from phenol and coal-tar creosote, as both give white precipitates; not less than 75 p. c. should distil at 200–220° C. (392–428° F.); cooled to –20° C. (–4° F.) becomes gelatinous, but does not solidify (dif. from phenol), inflammable, burning with luminous, smoky flame. *Tests*: 1. Stirred with equal volume collodion should yield no permanent coagulum (dif. from phenol and coal-tar creosote, and lim. of former). 2. Gives clear mixture with equal volume of glycerin, + one-fourth volume water yields deep creosotic layer (dif. from and lim. of phenols). 3. Precipitates with solutions of gum, albumin, but not with gelatin and collodion (dif. from phenol); ferric chloride T. S. gives violet-blue, grayish-green, muddy-brown, finally brown precipitate; crystallizes from

alcoholic potassium hydroxide. *Impurities*: Phenol, coal-tar creosote, neutral oils, cœrulignol and other high-boiling constituents of wood-tar. Dose,  $\text{m}\text{j}$ –10 (.06–.6 Cc.). The substance known as coal-tar creosote is of different composition, being impure phenol, made from coal-tar, consequently poisonous and unsuitable for medicine.

**PREPARATIONS.**—1. *Aqua Creosoti*. Creosote Water. (Syn., Fr. Eau créosotée; Ger. Kresotwasser.)

*Manufacture*: Agitate vigorously creosote 1 Cc., with distilled water 99 Cc., filter. Should be freshly prepared when dispensed. Dose,  $\text{3j}$ –4 (4–15 Cc.).

**PROPERTIES AND USES.**—Creosote—Internally, stimulant, antiseptic, parasiticide, anæsthetic; nausea, vomiting, diarrhœa, vomiting of pregnancy and of hysteria, cholera morbus, cholera infantum, typhoid fever, dysentery, tape-worm, diabetes, polyuria, phthisis; locally—burns, chilblains, erysipelas, menorrhagia, uterine hemorrhage, leucorrhœa, puerperal metritis, fetid otorrhœa, diphtheritic sore throat, chronic empyema, toothache, gleet, ulcers, cancer, gangrene, mercurial stomatitis, glanders, ozæna, itching, lupus, warts, condylomata, as a preservative of animal tissue. The water (aqua) used in leucorrhœa, gleet, burns, ulcers, eczema, prurigo, etc.

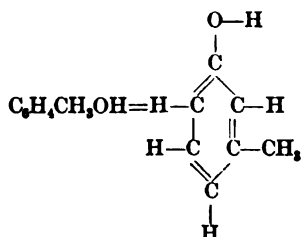
*Poisoning*: Same as for phenol (carbolic acid).

*Incompatibles*: Strong sulphuric and nitric acids, reduces silver salts, exploding on contact with the oxide.

*Allied Product*:

1. *Creosoti Carbonas*. *Creosote Carbonate*, *Creosotal*.—Obtained by passing current of carbon oxychloride into solution of creosote in sodium hydroxide solution. It occurs as thick, yellowish, oily liquid, odorless, tasteless, soluble in alcohol, chloroform, fatty oils (5 parts cod-liver), insoluble in water; contains 90 p. c. of creosote, analogous to guaiacol carbonate. Antitubercular, like creosote, but less irritating and poisonous; well tolerated by digestive system, decomposed in the intestine, imparting creosote odor to breath and urine; phthisis (lessens fever and night-sweats), croupous pneumonia, bronchitis, enteritis, ulcerations, intestinal indigestion. Dose,  $\text{m}\text{v}$ –10 (.3–.6 Cc.), capsule, emulsion.

**Cresol**. *Cresol*.—(Syn., *Cresolum*, *Cresylic Acid*, *Methylphenol*, *Tricresol*; Ger. *Kresol*, *Enterol*.) A mixture,  $\text{C}_6\text{H}_4(\text{CH}_3)\text{OH}$ , or  $\text{C}_7\text{H}_7\text{OH}$ , of three isomeric cresols obtained from coal-tar, freed from phenol, hydrocarbons and water.



**Manufacture:** Prepared from the "phenol" distillates of coal-tar between 140–220° C. (284–482° F.), by dissolving in sodium hydroxide solution, adding water and hydrochloric or sulphuric acid to separate hydrocarbons (benzene, naphthalene, toluene, etc.) and tarry matter; to filtrate add hydrochloric acid to precipitate cresols, leaving phenol in solution, purify by solution in sodium hydroxide and distilling with hydrochloric acid at 180–200° C. (356–392° F.). It consists of ortho-, meta-, and para-cresol, and is a colorless or straw-colored refractive liquid, phenol-like odor, yellowish-brown on exposure, sp. gr. 1.032, soluble in 60 parts water, miscible with petroleum benzin, benzene, alcohol, ether, glycerin, alkali hydroxide solutions. **Tests:** 1. Mix 1 Cc. with 1 Cc. aqueous solution sodium hydroxide (1 in 10), it should dissolve with no appreciable residue (abs. of or lim. of hydrocarbons). 2. Mix 1 Cc. with 1 Cc. glycerin, gives clear solution, add 1 Cc. water, when cresol completely separates (abs. of and dis. from phenol). **Impurities:** Hydrocarbons, phenol. Should be kept dark, in amber-colored bottles. Dose, Mj–3 (.06–.2 Cc.).

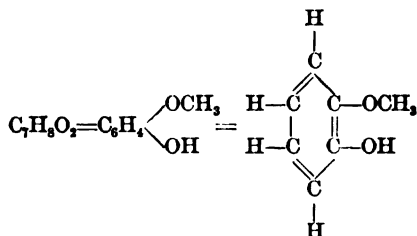
**PREPARATION.**—1. *Liquor Cresolis Compositus*. Compound Solution of Cresol. (Syn., Creolin; Fr. Soluté de Crésol composé; Ger. Liquor Cresoti Saponatus, Kreselseifenlösung.)

**Manufacture:** Dissolve potassium hydroxide 8 Gm. in water 5 Gm., add linseed oil 35 Gm., mix thoroughly, add cresol 50 Gm., stir until clear solution, add water q. s. 100 Gm. It is a clear brownish-yellow liquid, oil-like consistence, slippery to touch, darkens with age, froths when mixed and shaken with water, cresol odor, alkaline reaction.

**PROPERTIES AND USES.**—Antiseptic, germicide, disinfectant; far less poisonous than phenol, the meta- being most powerful; as sodium cresylate,  $C_7H_5ONa$ , soluble in water, or by sulphonation with sulphuric acid have creolin, lysol, sapocresol, saprol, solutol, solveol, etc. Liquor—sometimes sold as lysol, phenolin, sapocresol, etc., in 1–5 p. c. solutions as vaginal and intra-uterine douches following labor, in chronic and acute inflammations of pelvic organs, urethral and vesical irrigations in urethritis, cystitis, ophthalmia, wounds, abscesses, ulcers, sterilize instruments, hands, etc.; renders parts soft, pliable, not harsh and rough as with mercuric chloride.

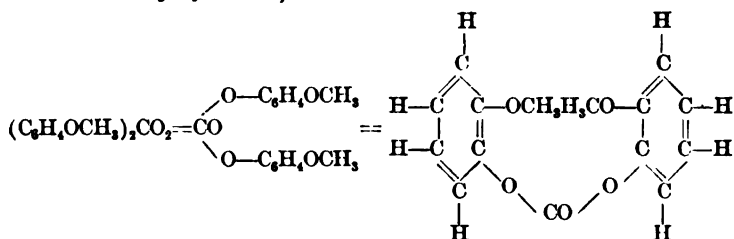
#### 4. DI-HYDROXY PHENOL DERIVATIVES.

**Guaiacol.** Guaiacol.—(Syn., Guaiacolum, Ortho-di-oxybenzene-methyl-ester, Methyl-orthodioxxybenzene, Methyl-pyrocatechin, Pyrocatechin (Catechol)-monomethylether; Fr. Gaïacol; Ger. Guajakol.)



**Manufacture:** This, the chief constituent of creosote, may be obtained (1) by distilling fractionally beechwood-tar at 200–205° C. (392–401° F.), treating this portion with ammonia to remove acid compounds, again distilling; now dissolve the lower boiling fraction in ether, treat with concentrated alcoholic solution potassium hydroxide, thereby separating potassium guaiacol, which is insoluble in ether, wash with ether, crystallize the salt from alcohol, decompose with dilute sulphuric acid, setting free the guaiacol, again rectify; (2), synthetically, from catechol (pyrocatechin) by methylating—heat at 170–180° C. (338–356° F.) equal molecules of catechol, potassium hydroxide and potassium methyl-sulphate,  $C_6H_4(OH)_2 + KOH + KCH_3SO_4 = C_6H_4OHOCH_3 + K_2SO_4 + H_2O$ , remove resulting guaiacol by solution in alcohol or petroleum ether, purify by recrystallization; (3), by diazotizing and boiling ortho-anisidin with nitrous acid, decomposing the newly formed diazoanisol with sulphuric acid, distilling liberated guaiacol in current of steam, redistilling, crystallizing. It is a colorless, crystalline solid, melting at 28.5° C. (83.3° F.), or colorless refractive liquid, boiling at 205° C. (401° F.), agreeable, aromatic odor, sp. gr. 1.140, soluble in alcohol, ether, acetic acid, 1 part glycerin, 53 water. **Tests:** 1. To alcoholic solution (1 in 100) add ferric chloride T. S., get blue color, changing to emerald-green, yellowish. 2. Add 1 Cc. to sulphuric acid 10 Cc., get yellowish color (reddish indicates creosote). **Impurities:** Oily hydrocarbons, creosote, etc. Dose, Mij–10 (.13–.6 Cc.).

**PREPARATION.**—1. *Guaiacolis Carbonas*. Guaiacol Carbonate.—(Syn., Duotal; Fr. Carbonate de Gaïacol; Ger. Guajacolcarbonat, Kohlensäure-Guajacyläther.)

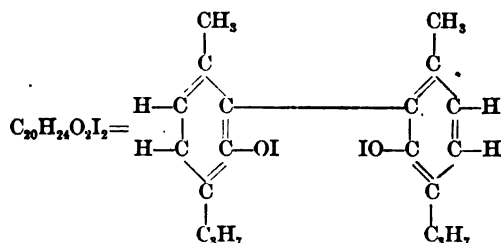


**Manufacture:** Pass slowly carbonyl chloride,  $COCl_2$  (phosgene gas), into guaiacol previously dissolved in sodium hydroxide solution, forming sodium chloride and guaiacol carbonate, the latter being insoluble separates, which is washed with solution sodium hydroxide, and crystallized from alcohol. It is a white crystalline neutral powder, nearly odorless, tasteless, soluble in 48 parts alcohol, 1.5 chloroform, 13 ether, sparingly in glycerin, fixed oils, insoluble in water, melts at 84° C. (184° F.); contains 91.5 p. c. of guaiacol. **Tests:** 1. Decomposed by alcoholic potassium hydroxide T. S., from which solution an acid separates guaiacol. 2. Alcoholic solution should not yield bluish-green color with ferric chloride T. S. (abs. of free guaiacol). Dose, gr. 5–30 (.3–2 Gm.).



**PROPERTIES AND USES.**—For the same purposes as creosote, but is less valuable and irritating to the intestinal canal and kidneys; phthisis, external tubercle, lupus, cough, expectoration, typhoid and other fevers, local anæsthesia, neuralgia, antiseptic.

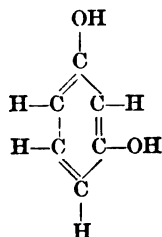
**Thymolis Iodidum. Thymol Iodide.**—(Syn., Aristolum, Aristol, Dithymoldiiodide, Annidalin.)



**Manufacture:** This is obtained by the condensation of 2 molecules of thymol, and the introduction of 2 atoms of iodine into the phenolic groups of the thymol: Potassium iodide is dissolved in solution of iodine, and thymol is dissolved in 12 p. c. solution sodium hydroxide, the two solutions are mixed, precipitate washed, dried; contains 45.8 p. c. of iodine. It is a bright, chocolate-colored, or reddish-yellow, bulky powder, slight aromatic odor, soluble in ether, chloroform, collodion, fixed and volatile oils, slightly in alcohol, insoluble in water, glycerin, melted and decomposed by heat, hot sulphuric acid with separation of iodine. **Impurities:** Iodides, alkalies, free iodine, ash. Should be kept dark, in amber-colored vials.

**PROPERTIES AND USES.**—Antiseptic. Similar to and a substitute for iodoform in skin diseases (lupus, psoriasis, etc.), tertiary syphilis. Apply in powder or ointment, with wool-fat, flexible collodion, etc.

**Resorcinol. Resorcinol,**  $\text{C}_6\text{H}_4(\text{OH})_2$ .—Fr. *res(in) + orc(hella) + in + (phen)ol*—i. e., resinous and peculiarly colored phenol substance.) (Syn., Resorcinum, U. S. P. 1890, Resorcin, Metadihydroxybenzene; Fr. Resorcine; Ger. Resorcin.)



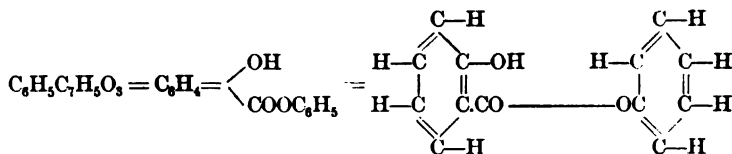
**Manufacture:** While this diatomic phenol may be made by fusing different resins, as galbanum, guaiac(um), ammoniacum, asafetida, etc., with caustic alkalies, or by the reaction of fused sodium hydroxide upon

sodium metabenzene disulphonate, it is obtained mostly by heating benzene with 4 times its weight of  $\text{H}_2\text{SO}_4$ , forming benzene metadisulphonic acid,  $\text{C}_6\text{H}_4(\text{HSO}_3)_2$ , which is dissolved in water and neutralized with milk of lime, the  $\text{CaSO}_4$  is expressed, and  $\text{Na}_2\text{CO}_3$  added, filtrate evaporated to dryness, which heated with  $\text{NaOH}$  forms sodium resorcinol,  $\text{C}_6\text{H}_4(\text{ONa})_2$ , boil to drive off  $\text{SO}_2$  and extract residue with ether, which being distilled leaves impure resorcinol; may purify by sublimation or recrystallization from water or benzene. It is in colorless, needle-shaped crystals, faint peculiar odor, sweetish, bitter taste, pinkish on exposure, soluble in alcohol, ether, glycerin, 0.5 part water, slightly in chloroform, carbon disulphide, benzene, volatile, neutral. *Tests*: 1. Aqueous solution (1 in 200) 10 Cc. + few drops ferric chloride T. S. gives bluish-violet color, changing by ammonia water to brownish-yellow (dis. from catechol, quinol). 2. Aqueous solution (1 in 2) should be colorless (abs. of empyreumatic bodies), and upon gentle heat should not emit odor of phenol. *Impurities*: Catechol, quinol, empyreumatic bodies, phenol odor. Should be kept in dark-amber bottles. Dose, gr. 2-5 (.13-.3 Gm.).

**PROPERTIES AND USES.**—Allied to phenol (carbolic acid); antipyretic, depressant; gastric ulcer, fermentative dyspepsia (an hour after food), vomiting, cholera infantum, diarrhoea, rheumatism, typhoid fever, pneumonia, scarlatina, pleurisy, phthisis, cystitis, vomiting, seasickness. Solution in chronic otitis, gonorrhoea, leucorrhoea, whooping-cough, chronic aphonia, laryngeal ulcers, gangrene, morbid growths, boils, carbuncles, frostbites, ulcers, fissures, erysipelas, erythema, eczema, psoriasis, herpes, alopecia, chancres, papilloma, myomas, diphtheria; as the basis of dyes—resorcin-blue, -brown, -green, etc.

*Poisoning*: Same as for phenol (carbolic acid).

**Phenylis Salicylas.** Phenyl Salicylate,  $\text{C}_{13}\text{H}_{10}\text{O}_3$ .—(Syn., Salol, U. S. P. 1890; Fr. Salicylate de Phénol (Phényle); Ger. Phenylum salicylicum, Salolum, Phenylsalicylat, Salicylsäurephenylester.)



**Manufacture**: This salicylic ester of phenyl may be obtained by several processes: 1. Treat sodium phenol(ate) + sodium salicylate with a dehydrating agent, as phosphorus oxychloride, or with a slow current of phosgene (carbonyl chloride)— $2\text{C}_6\text{H}_5\text{ONa} + 2\text{C}_6\text{H}_4(\text{OH})\text{CO}_2\text{Na} + \text{POCl}_3 = 2\text{C}_6\text{H}_4(\text{OH})\text{CO}_2\text{C}_6\text{H}_5 + 3\text{NaCl} + \text{PO}_3\text{Na}$ ; dissolve resulting salol in alcohol, crystallize. 2. Heat salicylic acid in an atmosphere of carbon dioxide—(1)  $2\text{HC}_7\text{H}_5\text{O}_3 + \text{heat} = (\text{C}_6\text{H}_4\text{CO}_2\text{H})_2\text{O} + \text{H}_2\text{O}$ . (2)  $(\text{C}_6\text{H}_4\text{CO}_2\text{H})_2\text{O} + \text{C}_6\text{H}_5\text{C}_7\text{H}_5\text{O}_3 + \text{CO}_2$ . It is changed first into its anhydride and then into phenyl salicylate; dissolve in alcohol,

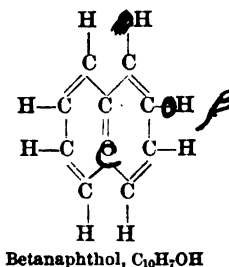
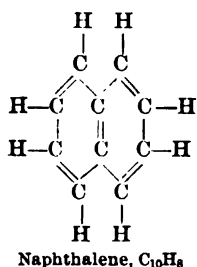
crystallize. It is a white, crystalline powder, faint, aromatic odor, slight, characteristic taste, soluble in ether, chloroform, fixed and volatile oils, 5 parts alcohol, 2,333 water, melts at  $42^{\circ}$  C. ( $108^{\circ}$  F.), no residue. *Tests*: 1. Alcoholic solution + diluted ferric chloride T. S. gives violet color. 2. Dissolve 0.2–0.3 Gm. in little warm sodium hydroxide T. S., acidify with hydrochloric acid, get salicylic acid separated and odor of phenol. *Impurities*: Uncombined phenol, salicylic acid, free acids, chlorides, sulphates. Dose, gr. 5–30 (.3–2 Gm.), in pill, capsule, emulsion, or milk.

**PROPERTIES.**—Antiseptic, antipyretic, antirheumatic.

**USES.**—Rheumatism, neuralgia, lancinating pains, diarrhoea, dysentery, cholera, ulcers, ozæna, diphtheria, gonorrhoea, otorrhoea, vesical catarrh, fermentative dyspepsia, typhoid fever, cystitis, substitute for iodoform in surgery. Salol in the small intestine splits into phenol 36 p. c. and salicylic acid 64 p. c., consequently salol is more dangerous than salicylic acid from the presence of phenol, which latter colors the urine dark. Death has been occasioned by gr. 15 (1 Gm.), and by gr. 120 (8 Gm.), in each case signs of phenol- (carbolic acid) poisoning being present.

## 5. NAPHTHALENE DERIVATIVES.

**Naphthalenum.** Naphthalene,  $C_{10}H_8$ .—(L. *naphth(a)* + *al(cohol)* + *ene*, referring to its components.) (Syn., Naphtalinum, U. S. P. 1890, Naphtalin, Tar Camphor, Camphor Balls; Fr. Naphthaline, Naphtalène; Ger. Naphthalin.)



**Manufacture**: This hydrocarbon, obtained from coal-tar and purified by crystallization, is formed by the union of 2 benzene groups, so as to have 2 carbon atoms in common, by distilling coal-tar between  $180$ – $250^{\circ}$  C. ( $356$ – $482^{\circ}$  F.), when the distillate gradually deposits a dark crystalline substance, consisting chiefly of impure naphthalene, which is treated successively with NaOH and  $H_2SO_4$  (to remove acid and basic by-products—phenols, aniline, etc.), then purified by distillation in the presence of steam, further heating with  $H_2SO_4$  and distilling. It is in colorless, shining, transparent laminæ, strong characteristic odor of coal-tar, burning, aromatic taste, slowly volatilized and brownish by exposure, insoluble in water, soluble in 13 parts alcohol, freely in ether, chloroform, carbon disulphide, fixed and volatile oils. *Test*: 1. On shaking with sulphuric acid should remain colorless, and if heated 5

minutes should not acquire more than a pale reddish tint (abs. of impurities derived from coal-tar). Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 2–15 (.13–1 Gm.).

**PROPERTIES AND USES.**—Antiseptic, expectorant, parasiticide, vermifuge; intestinal catarrh, inflammation, typhoid fever, diarrhoea, whooping-cough, chronic bronchitis, bronchorrhœa, wounds, ulcers, scabies, dysentery, prurigo. Dissolved in alcohol and used like spirit of camphor, for sprains, contusions.

**Betanaphthol.** Betanaphthol,  $C_{10}H_7OH$ .—(Gr.  $\beta$ , second letter of alphabet—Beta + *νᾰφθᾱ*; L. *naphth(a)* + *ol(eum)*—i. e., second of several isomeric compounds from this origin.) (Syn., Naphthol, U. S. P. 1890, Beta-mono-hydroxy-naphthalene, Iso-naphthol; Ger. Naphtholum.)

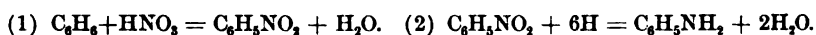
**Manufacture:** This monatomic phenol occurring in coal-tar is prepared usually from naphthalene by allowing sulphuric acid to act upon it for several hours at  $200^{\circ} C.$  ( $392^{\circ} F.$ ), forming  $\beta$ -naphthalene sulphonic acid,  $C_{10}H_7HSO_3$ ; at  $80$ – $90^{\circ} C.$  ( $176$ – $194^{\circ} F.$ ) much alpha acid is produced, which at the higher temperature is converted into the beta variety, now dissolve this acid in water, saturate with milk of lime, when the resulting calcium salt separates by crystallization, dissolve crystals in water, decompose by  $Na_2CO_3$ , getting sodium naphthalene sulphonate,  $C_{10}H_7SO_3Na$ , which added to fused  $NaOH$  yields sodium naphthol,  $C_{10}H_7ONa$ , and sodium sulphite,  $NaSO_3$ ; the sodium naphthol treated with  $HCl$  gives betanaphthol, which may be purified by sublimation and recrystallization from hot water or benzin; it bears the same relation to naphthalene as phenol does to benzene. It is in colorless or pale buff-colored, shining crystalline laminæ or white, yellowish-white crystalline powder, faint phenol-like odor, sharp, pungent but not persistent taste, permanent, soluble in 950 parts water, 0.61 alcohol, ether, chloroform, solutions alkali hydroxides; melts at  $122^{\circ} C.$  ( $252^{\circ} F.$ ), boils at  $286^{\circ} C.$  ( $547^{\circ} F.$ ), no residue. **Test:** 1. Aqueous solution + few drops iodine T. S., + sodium hydroxide in excess should give no color (dis. from alphanaphthol, which gives intense violet). **Impurities:** Naphthalene, alphanaphthol (poisonous), organic substances. Should be kept in well-stoppered, dark amber-colored bottles. Dose, gr. 2–5 (.13–.3 Gm.).

**PROPERTIES AND USES.**—Antiseptic, antifermentative, deodorizer, stimulant, typhoid fever, ozæna, eczema, prurigo, herpes, favus, conjunctivitis, chronic laryngitis, otitis, ringworm, psoriasis, scabies, abscesses, acne, diarrhoea, dysentery. Apply in alcoholic solution, 1–2 p. c., or ointment, 10–15 p. c.

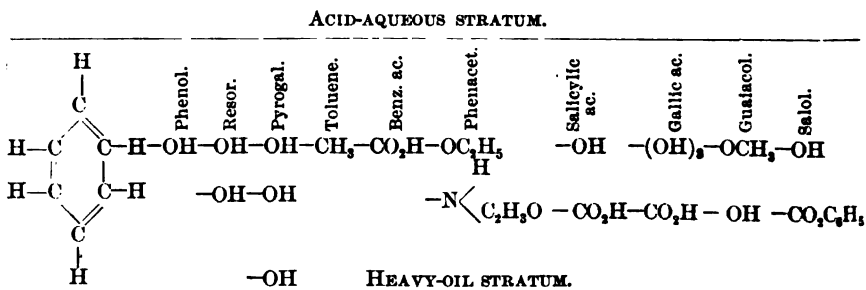
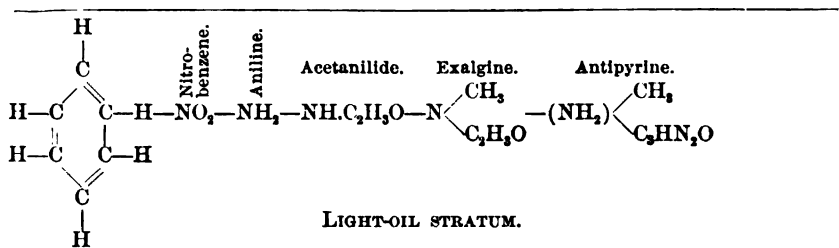
## 6. BENZENE DERIVATIVES CONTAINING NITROGEN.

By analysis the exact molecular composition of many vegetable alkaloids has been determined, and inasmuch as many of these are troublesome to extract, hence expensive to the consumer, experimenters have

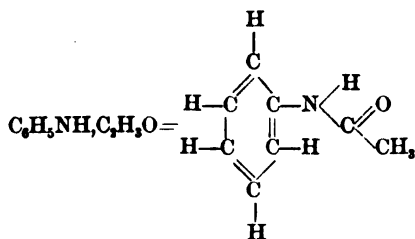
interested themselves in trying to reproduce artificially such substances by joining their elements synthetically in the proper proportions. While this has often been found impracticable, yet the building, substitution, and replacement of elements with such an end in view have been remarkably successful. The greatest satisfaction has resulted from starting with basal products which contain the necessary elements in a condition or form susceptible of ready displacement. The cheapest and most acceptable base so far discovered is coal-tar, of which mention has been made in several connections. In experimenting with coal-tar, myriads of approximate principles or alkaloids have been formed, many of which, although not having the exact formulæ, are identical in most respects with its vegetable prototype. Beginning with coal-tar—in the first place it is distilled to obtain benzene, which is converted by nitric acid into nitrobenzene, and into this nascent hydrogen is passed, producing aniline or phenylamine,  $C_6H_5NH_2$ :



Aniline (Ar. *anil*, indigo—*i. e.*, its brilliant violet and indigo dyes) is therefore the assumed basal product, which is a colorless, oily, alkaline liquid, peculiar aromatic odor, bitter taste, boiling at  $181^\circ C.$  ( $359^\circ F.$ ), insoluble in water, poisonous; it is an amine acting like a base, hence combines with acids, forming well-defined salts.



**Acetanilidum. Acetanilide.**—(Fr. *acet(ic)* + *anil(ine)* + *ide*—*i. e.*, referring to its components.) (Syn., Phenylacetamide, Antifebrinum, Antifebrin, Acetylamidobenzene; Fr. *Acétanilide*; Ger. *Antifebrin*.)



*Manufacture*: This monacetyl derivative of aniline is obtained from the latter by replacing its hydrogen by the acetic acid radical—acetyl,  $\text{C}_2\text{H}_3\text{O}$ —by boiling together aniline and glacial acetic acid for 1–2 days; now distil, collect portion passing over at  $295^\circ \text{C}$ . ( $563^\circ \text{F}$ .), and when cool acetanilide congeals— $\text{C}_6\text{H}_5\text{NH}_2 + \text{HC}_2\text{H}_3\text{O}_2 = \text{C}_6\text{H}_5\text{NHC}_2\text{H}_3\text{O} + \text{H}_2\text{O}$ ; can purify by repeated crystallization from water. It is in white, shining, micaceous, crystalline laminæ or powder, odorless, faintly burning taste, permanent, soluble in 179 parts water, 18 boiling water, 2.5 alcohol, 12 ether, 5 chloroform. *Tests*: 1. Heat 0.1 Gm. with 10 Cc. water, when cold filter, add bromine T. S., drop by drop, getting white precipitate of parabromacetanilide (dis. from antipyrine, acetphenetidin). 2. Cold saturated aqueous solution added to ferric chloride T. S. should not affect color of latter (abs. of aniline salts, various allied substances). *Impurities*: Methylacetanilide, antipyrine, acetphenetidin, aniline salts, etc. Dose, antipyretic, gr. 5 (.3 Gm.), anodyne, gr. 1–2 (.06–.13 Gm.), in pill, tablet, capsule, or in alcohol, then diluted in water; may repeat every 4 hours.

*PREPARATION*.—1. *Pulvis Acetanilidi Compositus*. Compound Acetanilide Powder. (Syn., Fr. Poudre d'Acétanilide composée; Ger. Zusammengesetztes Antifebrinpulver.)

*Manufacture*: Acetanilide 70 Gm., caffeine 10, sodium bicarbonate 20; reduce each to fine powder, mix thoroughly. Dose, gr. 5–10 (.3–.6 Gm.).

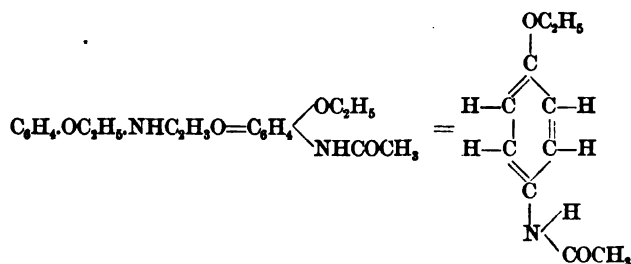
*PROPERTIES*.—Antipyretic, analgesic, antispasmodic, diuretic (increases excretion of urea and uric acid), diaphoretic. Small doses cause quietness; if large have headache, weakness, ringing in ears, a peculiar cyanosis, somnolence, mydriasis, temperature falls, slow respiration, feeble, irregular pulse, vomiting, profuse sweat, coma, collapse, general paralysis, dark urine, oxygen-carrying power of the blood is diminished, and corpuscles may be destroyed; blue color due to reduction of hæmoglobin to methæmoglobin in the blood. In the system acetanilide breaks up into acetic acid and aniline, and this latter oxidizes into paramidophenol. Action is chiefly on heart, liver, and kidneys, causing fatty degeneration; continued use is highly injurious.

*USES*.—Phthisis, typhoid fever, hyperpyrexia, sthenic fevers, gastralgia, locomotor ataxia, rheumatism, sciatica, lumbago, neuralgia, gangrene, cancer, headache, insomnia, epilepsy, whooping-cough. There are many proprietary preparations containing 50–90 p. c. of acetanilide with sodium bicarbonate, ammonium or sodium bromide, salicylic acid, etc.

*Poisoning:* Have sweating, depression, slow breathing, irregular pulse, collapse, vomiting, cyanosis, prostration, death. Empty stomach, place in recumbent position, loosen clothing, plenty fresh air (for cyanosis), give diffusible stimulants (brandy, whisky, alcohol, ammonia, ether injections), coffee, atropine, strychnine (hypodermic), heat to feet and body, oxygen inhalations, rub skin, castor oil.

*Incompatibles:* Caustic soda and potash, chloroform.

**Acetphenetidinum.** Acetphenetidín.—(Syn., Phenacetinum, Phenacetin, Para-acetphenetidín, Para-ethoxyacetanilide; Fr. Amido-acétique del'amido-phenetol; Ger. Phenacetin.)



*Manufacture:* This phenol derivative is the product of the acetylation of para-amidophenetol, and is obtained by acting upon phenol with dilute nitric acid, producing ortho- and paranitrophenol— $\text{C}_6\text{H}_5\text{OH} + \text{HNO}_3 = \text{C}_6\text{H}_4(\text{NO}_2)(\text{OH}) + \text{H}_2\text{O}$ ; as para-nitrophenol is non-volatile, the two are separated by distillation with steam, the residuary para- being decolorized and crystallized, by action of sodium hydroxide we have formed sodium nitrophenol,  $\text{C}_6\text{H}_4(\text{NO}_2)(\text{ONa})$ , which is heated with ethyl iodide and converted into para-nitrophenetol— $\text{C}_6\text{H}_4(\text{NO}_2)(\text{ONa}) + \text{C}_2\text{H}_5\text{I} = \text{C}_6\text{H}_4(\text{NO}_2)(\text{OC}_2\text{H}_5) + \text{NaI}$ . The latter compound by action of nascent hydrogen is converted into paraphenetidin— $\text{C}_6\text{H}_4(\text{NO}_2)(\text{OC}_2\text{H}_5) + \text{H}_2 = \text{C}_6\text{H}_4(\text{NH}_2)(\text{OC}_2\text{H}_5) + 2\text{H}_2\text{O}$ ; prolonged boiling with glacial acetic acid converts paraphenetidin into para-acetphenetidín, just as aniline is converted into acetanilide. It is in white, glistening, crystalline scales or powder, odorless, tasteless, soluble in 925 parts water, 12 alcohol, 63 ether, 20 chloroform, melts at  $135^\circ \text{C}$ . ( $275^\circ \text{F}$ .). *Tests:* 1. Boil 0.1 Gm. with 10 Cc. water, the cooled, filtered solution should not be turbid with slight excess of bromine T. S. (abs. of acetanilide). 2. 0.3 Gm. with 1 Cc. of 90 p. c. alcohol should not acquire red tint when diluted with three times its volume of water and boiled with 1 drop  $\frac{\text{N}}{10}$  iodine V. S. (abs. of paraphenetidin). Dose, gr. 3–10 (.2–.6 Gm.).

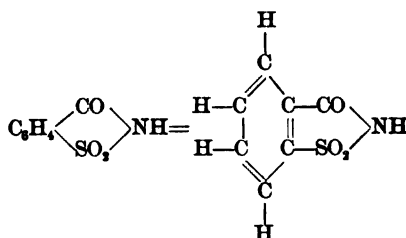
**PROPERTIES AND USES.**—Antipyretic, analgesic, cardiac depressant, diuretic, safer than antipyrine or acetanilide; neuralgia, sciatica, locomotor ataxia, migraine, headache, hysteria, asthma, whooping-cough, epilepsy, rheumatism, chronic myelitis, arthritis, cystitis, metritis, acute neuritis, pleurisy, dysmenorrhœa. For any paroxysm of headache, etc., give gr. 3 (.2 Gm.) every hour until 3 or 4 doses are taken; it is

decomposed in the system into phenetidin and amidophenol, and is eliminated chiefly by the kidneys.

*Poisoning*: Excessive quantity may produce vomiting, sweating, feeble and rapid pulse, collapse; treat as for acetanilide, with alcoholic stimulants, strychnine hypodermically, warmth externally, etc.

*Methyl Phenacetin*,  $C_6H_4OC_2H_5CH_3C_2H_5O$ , and *Ethyl Phenacetin*,  $C_6H_4OC_2H_5C_2H_5C_2H_5O$ , are also hypnotics, the first being the stronger.

**Benzosulphinidum. Benzosulphinide, Saccharin.**—(Syn., Glusidum, Gluside, Neosaccharin, Glucusimide, Anhydro-orthosulphamidebenzoic Acid; Fr. Acide Anhydro-Orthosulfamide-Benzoïque; Ger. Benzoesauresulfimid, Zuckerin, Toluolsuss, Saccharol, Sycose.)



*Manufacture*: This anhydride of ortho-sulphamidebenzoic acid (benzoyl sulphonicimide) is prepared by a process involving six different steps: Take  $C_6H_5CH_3$  (toluene) +  $H_2SO_4$  +  $100^\circ C.$  ( $212^\circ F.$ ) =  $C_6H_4(CH_3)SO_3H$  (ortho- and para-toluenesulphonic acids), which are converted into calcium and then sodium salts by sodium carbonate; act upon these with phosphorus pentachloride = ortho- and para-toluenesulphochlorides,  $C_6H_4(CH_3)SO_2Cl$ , cool, when para-crystallizes out; to ortho-add ammonia gas = ortho-toluenesulphamide,  $C_6H_4(CH_3)SO_2NH_2$ , which is oxidized with potassium permanganate = potassium ortho-sulphamidebenzoate, and this freed from precipitated manganese dioxide and decomposed by an acid splits up into its aldehyde and water, instead of separating as free ortho-sulphamidebenzoic acid. It is a white, crystalline powder, nearly odorless, intensely sweet taste even in dilute solutions (1 in 100,000), 280 times sweeter than sugar, soluble in ammonia water, sodium bicarbonate or alkali hydroxide solutions, 250 parts water, 25 alcohol, slightly in ether or chloroform, melts at  $220^\circ C.$  ( $428^\circ F.$ ). *Impurities*: Inorganic substances, carbohydrates, glucose, milk-sugar, benzoic and salicylic acids. Dose, gr. 1-4 (.06-.26 Gm.).

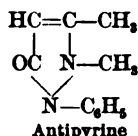
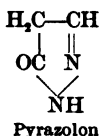
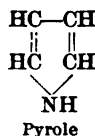
**PROPERTIES AND USES.**—As a substitute for sugar, in diabetic or gouty patients; antiseptic, retards action of digestive ferments, hence should be used with caution where digestion is impaired.

## VI. Organic Bases.

**Antipyrina. Antipyrine**,  $C_{11}H_{12}N_2O$ .—(Syn., Phenazonum, Phenazone, Methozine, Analgesine, Dimethylphenyl-isopyrazolone, Dehydrodimethylphenylpyrazine; Fr. Analgesine, Anodynine, Parodyne; Ger.



Pyrazolonum phenyldimethylicum, Antipyrin.) This is phenyldimethylpyrazolon, obtained by the condensation of phenylhydrazine with aceto-acetic ether and methylation of the product.



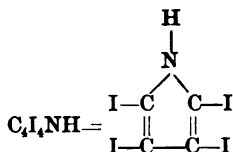
*Manufacture:* Aniline chloride or sulphate is treated with sodium nitrite, the resulting diazobenzene chloride or sulphate is treated with reducing agents (alkali sulphite and stannous chloride), forming phenylhydrazine,  $\text{C}_6\text{H}_5\text{HN.NH}_2$ , which is heated with aceto-acetic ether,  $\text{CH}_3\text{CO.CH}_2\text{OOC.C}_6\text{H}_5$ , producing phenylmethyl-isopyrazolone,  $\text{C}_6\text{H}_5\text{N.CO.CH:C(CH}_3\text{).NH}$ ; dissolve this in methyl alcohol, heat with methyl iodide, this compound treated with solution sodium hydroxide splits off hydriodic acid and separates antipyrine, as a heavy oil, which can be crystallized from toluene or ether. It is a colorless, almost odorless, crystalline powder or tabular crystals, slightly bitter taste, soluble in 1 part water, 1 alcohol, 1 chloroform, 30 ether, melts at  $113^\circ \text{C. (235}^\circ \text{F.)}$ , no residue, unites with acids to form salts. *Tests:* 1. Aqueous solution (1 in 100) 12 Cc. + sodium nitrite 0.1 Gm. gives nearly colorless liquid, but becomes deep green upon adding diluted sulphuric acid (isonitroso-antipyrine). 2. Aqueous solution (1 in 1,000) 2 Cc. + 1 drop ferric chloride T. S. gives deep red color, + sulphuric acid changes to light yellow. *Impurities:* Acetanilide, acetphenetidin, etc. Dose, gr. 2–20 (.13–1.3 Gm.).

**PROPERTIES AND USES.**—Antiseptic, anodyne, antipyretic, cardiac depressant, hæmostatic, diuretic, antineuralgic, analgesic, contracts the bloodvessels, migraine, locomotor ataxia, rheumatism, neuritis, urticaria, chorea, gout (arthritis), whooping-cough, tetanus, epilepsy, spasmodic laryngitis, sciatica, labor pains, diabetes, gravel, dysmenorrhœa, headache, angina pectoris, cancer, syphilitic pains, biliary and renal colic, skin diseases, eye affections, locally to ulcers and as a hæmostatic. Antipyrine resembles acetanilide very closely, and owing to its larger dose should be handled with even more caution.

*Poisoning:* Similar to acetanilide.

*Incompatibles:* Iron chloride, iodide, and sulphate, copper sulphate, iodine, arsenic iodide, sodium bicarbonate, phenol (carbolic acid), hydrocyanic acid, nitric acid, nitrites, potassium permanganate, salicylates, calomel, corrosive sublimate, spirit nitrous ether. All tannin preparations give white precipitate, and hydrated chloral decomposes it.

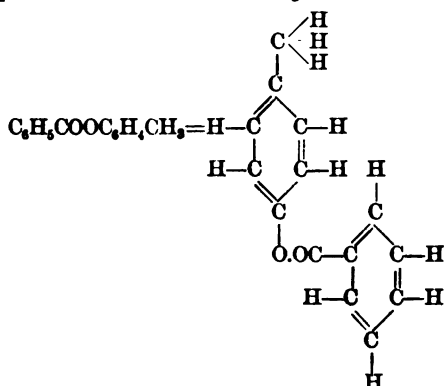
**Iodolum.** Iodol,  $\text{C}_4\text{I}_4\text{NH}$ .—(Syn., Tetraiodo-pyrrol, Pyrrol Tetraiodide; Ger. Tetrajodpyrrol.)



**Manufacture:** Pyrrol, which is obtained from Dippel's oil (bone oil), is purified and acted upon with iodine in alcoholic solution for 24 hours, when water is added and iodol separates. It is a light grayish-brown crystalline powder, odorless, tasteless, soluble in fixed oils, sulphuric acid, 9 parts alcohol, 1.5 ether, 105 chloroform, 4,900 water, decomposes at 145° C. (293° F.), liberating violet iodine vapors; contains iodine 88.97 p. c. **Impurities:** Inorganic substances, hydriodic acid, iodides, free iodine. Dose, gr.  $\frac{1}{2}$ –10 (.03–.6 Gm.).

**PROPERTIES AND USES.**—Antiseptic, stimulant, a substitute for iodoform externally and for potassium iodide internally; tertiary syphilis, scrofula, diabetes, eczema, wounds.

**Benzo-para-cresol. Para-cresyl-benzoate.**



**Manufacture:** Benzoyl chloride is allowed to act on the sodium salt of para-cresol. It is in colorless needles, soluble in chloroform, ether, hot water, insoluble in water; melts at 71° C. (160° F.).

**PROPERTIES AND USES.**—Antiseptic. The preparations creolin, lysol, saprol, solutol, solveol, sozal, etc., are complex mixtures of the three cresols—ortho, meta, para.

**Creolin. Creolinum.**—Creolins are antiseptic and disinfectant soluble preparations of cresols (free from phenol) made soluble by means of rosin soap or sulphonation with sulphuric acid. Those with soap are usually reddish-black syrupy liquids, tarry odor, sp. gr. 1.040–1.070, forming clear solutions with alcohol, ether, chloroform, benzine, benzene; the sulphonated creolins hold free cresols in solution, forming milky emulsions with water; sodium salicylate is also a good solvent of cresols. Dose, mj–5 (.06–.3 Cc.).

**PROPERTIES AND USES.**—Antiseptic, sedative; it is powerful but non-irritating. Used as a substitute for phenol (carbolic acid), anti-fermentative. Internally, for gastric fermentation, dysentery, and typhoid fever.

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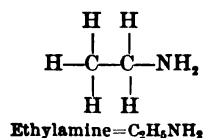
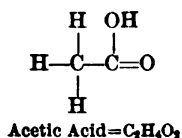
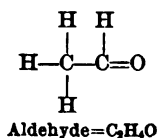
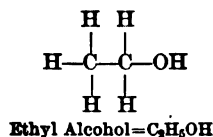
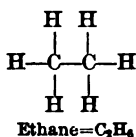
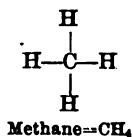
# PART V.

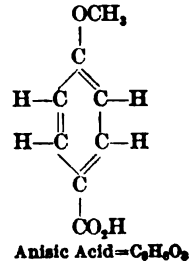
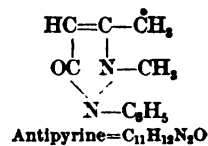
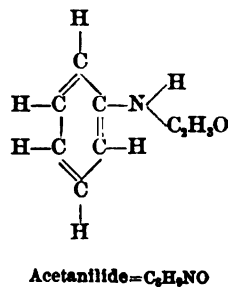
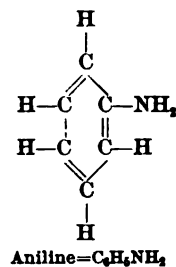
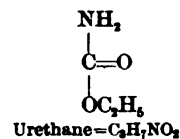
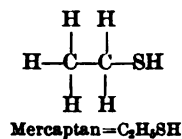
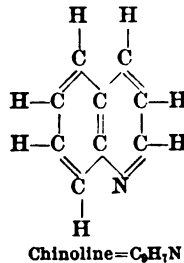
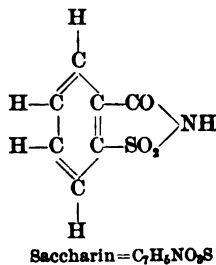
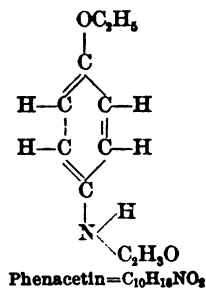
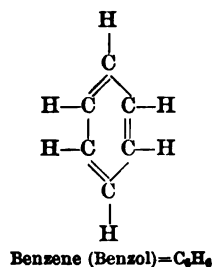
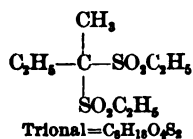
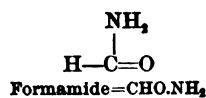
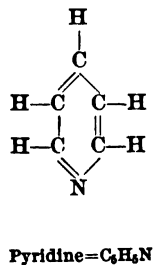
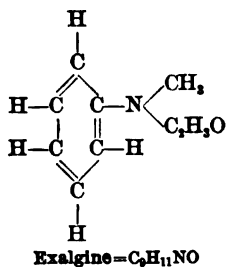
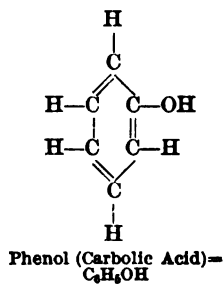
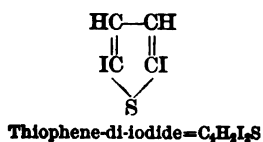
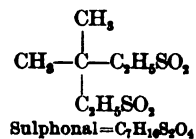
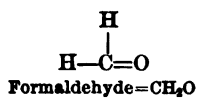
## NON-PHARMACOPŒIAL ORGANIC CARBON COMPOUNDS.

(SYNTHETIC REMEDIES.)

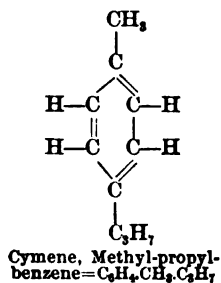
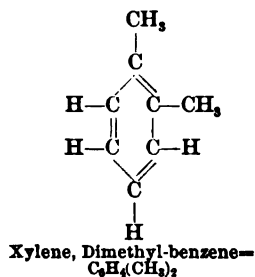
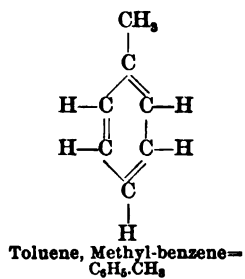
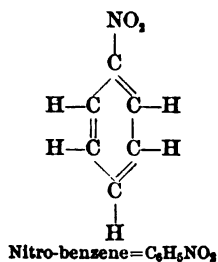
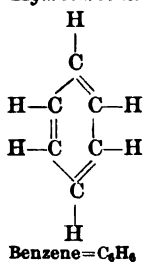
It should be borne in mind, as incidentally referred to on page 809, that the possibilities which the constructive processes of organic chemistry open to us are almost beyond limit. Not a few of those products which we have solely heretofore, and do mostly even now, depend upon crude vegetable drugs for their origin, are at the present time being built up synthetically to such perfection as often to challenge recognition of distinctive sources. Of these, the *Pharmacopœia* would recognize more than it does were it not for partial secrecy in working formula and manufacture. Quite a number are employed so universally that the present day text-book excluding them might be considered decidedly incomplete. In order that their chemical relationship may be the better understood they have been treated, so far as practicable, in the same ordered sequence as adopted in Part IV. Before taking them up individually, it may be well to show, by graphic formulas, the facility with which the construction and substitution of one atom or a group of atoms for others may be effected—a process which invariably results in giving each time a different substance. In order to do this, and to carry along direct relationship, some of the compounds previously treated will have to be introduced at the sacrifice of repetition, but this may be considered not in the least a disadvantage to the student.

The majority of these synthetics which contain sulphur are hypnotics or sleep-producers, while those containing nitrogen are antipyretics or anodynes.

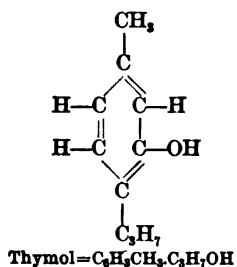
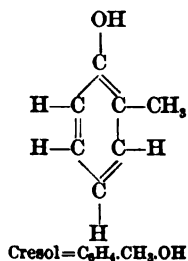
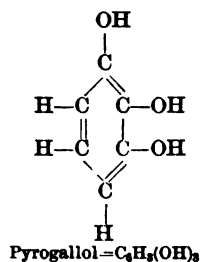
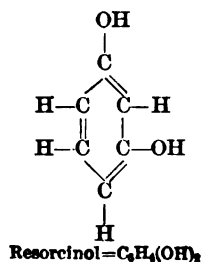
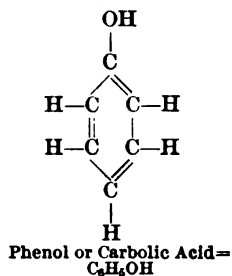




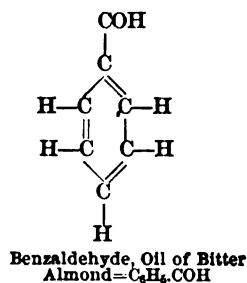
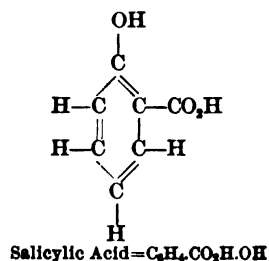
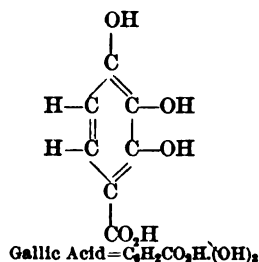
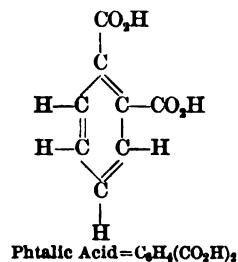
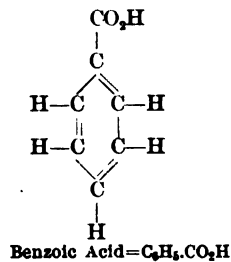
*Hydrocarbons.*



*Alcohols.*



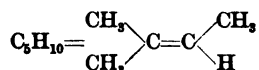
*Acids.*



## I. FATTY SERIES (PARAFFIN OR METHANE).

(OPEN-CHAIN COMPOUNDS.)

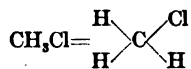
## I. Hydrocarbons.

**Pental.** Pentalum.—Tri-methyl-ethylene, Iso-amylene.

*Manufacture:* This is from the fifth member of the series, amylene. The amyl hydride (hydroxide) or amylic alcohol is digested with zinc chloride for 24 hours, or preferably the two are shaken occasionally together for some time with diluted sulphuric acid; thus is produced amyl sulphuric acid, which when diluted with water yields tertiary amyl alcohol and pure pental, which latter may be separated by fractional distillation. It is a colorless liquid, very inflammable and volatile, not affected by light or air, insoluble in water, miscible in all proportions with alcohol, chloroform, and ether, sp. gr. 0.620, boils at 38° C. (100.4° F.).

**PROPERTIES AND USES.**—Anæsthetic; when inhaled acts as rapidly and safely as nitrous oxide gas, and superior to it in having a longer action and no unpleasant after-effect; acts more promptly than chloroform (1–3 minutes). Consciousness is not lost when the stage of pain-insensibility is reached; stage of exhilaration is seldom present; and drug does not lose effect by repetition. It is used for minor surgical operations, tooth-extraction, etc., being administered like chloroform. Dose,  $\text{M}\nu$ –10 (.3–.6 Cc.) internally, but for inhalation  $\text{ʒij}$ –4 (8–15 Cc.).

## 1. HALOGEN DERIVATIVES.

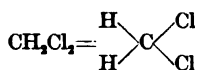
**Methyl Chloride.** Mono-chlor-methane.

*Manufacture:* Methyl alcohol, hydrochloric acid (gas), and zinc chloride are heated together under pressure in a steam digester— $\text{CH}_3\text{OH} + \text{HCl} = \text{CH}_3\text{Cl} + \text{H}_2\text{O}$ ; the zinc chloride simply facilitates the process; the methyl chloride has now to be purified by washing with water, acid, and alkali. It is a colorless gas, burning with a green flame, having an ether and chloroform-like odor, 1 vol. water dissolves 4 vols., while 1 vol. methyl or ethyl alcohol dissolves 35 vols.; it is also freely soluble in ether and chloroform. When cooled to –23° C. (–11.4° F.), under normal pressure, becomes a liquid which boils at –21° C. (–5.8° F.); a pressure of 5 atmospheres at normal temperature also condenses it.

**PROPERTIES AND USES.**—Local anæsthetic. It is kept usually in pointed glass pearls; the point being broken off, the heat of the hand is sufficient to volatilize the contents, and thus force it out as a fine

spray upon the desired part of application. Before applying, it is well to wash the skin with soap and water to remove all fat, and to hold spray-nozzle 10 inches from the spot to be frozen. The skin soon becomes white and parchment-like, and then minor surgical operations, as opening abscesses, boils, etc., may be performed painlessly. The spray should not be continued longer than 2-4 minutes, as death of tissue may result.

**Methylene Bichloride. Di-chlor-methane.**



*Manufacture:* Pass chlorine into methyl chloride ( $\text{CH}_3\text{Cl}$ ), or reduce chloroform ( $\text{CHCl}_3$ ) with zinc and hydrochloric acid. It is a colorless liquid, chloroform-like odor, insoluble in water, soluble in alcohol or ether, sp. gr. 1.354, boils at  $40^\circ \text{C}$ . ( $104^\circ \text{F}$ ). It should be kept in well-stoppered bottles, in the dark, to prevent decomposition; this may also be obviated by the addition of 1 p. c. alcohol. Dose,  $\text{m}\times\text{--}30$  (.6-2 Cc.), but mostly inhaled.

**PROPERTIES AND USES.**—Anæsthetic; for minor operations use  $\text{zj--}2$  (4-8 Cc.), for major ones, should not employ more than  $\text{zij--}6$  (12-24 Cc.).

**Methylthionine Hydrochloride. Methylthioninæ Hydrochloridum,  $\text{C}_{16}\text{H}_{18}\text{N}_3\text{SCl}$ .**—(*Official.*) See page 823.

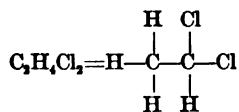
**Methyl Tri-chloride. Chloroformum. Chloroform.**—Tri-chlor-methane,  $\text{CHCl}_3$ .—(*Official.*) See page 824.

**Methyl Tri-bromide. Bromoformum. Bromoform.**—Tri-brom-methane,  $\text{CHBr}_3$ .—(*Official.*) See page 827.

**Methyl Tri-iodide. Iodoformum. Iodoform.**—Tri-iodo-methane,  $\text{CHI}_3$ .—(*Official.*) See page 827.

**Ethyl Chloride. Æthylis Chloridum. Mono-chlor-ethane,  $\text{C}_2\text{H}_5\text{Cl}$ .**—(*Official.*) See page 829.

**Ethylene Bichloride. Æthyleni Bichloridum.**—Ethene Chloride, Dutch Liquid.

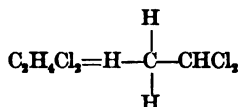


*Manufacture:* Combine equal volumes of the unsaturated hydrocarbon ethylene ( $\text{C}_2\text{H}_4$ ) and chlorine ( $\text{Cl}_2$ ). It is a colorless, thin, oily, volatile liquid, sweet taste, chloroform-like odor, sp. gr. 1.26, boils at  $85^\circ \text{C}$ . ( $185^\circ \text{F}$ ), soluble in alcohol or ether, sparingly in water.

**PROPERTIES AND USES.**—Anæsthetic. Much safer than chloroform (no collapse), also more pleasant and rapid in action, causes no excitement like ether, and recovery is more rapid. It is, however, more expensive than chloroform, and irritates the throat so much that it is used with difficulty. It is efficacious locally in neuralgia.



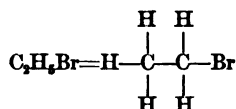
**Ethylidene Chloride. Di-chlor-ethane.**—Mono-chlorinated Hydrochloric Ether.



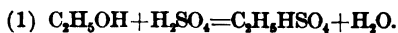
This is isomeric with ethylene bichloride, which it resembles in odor; it has a density of 1.198, boils at 57.5° C. (135.5° F.), and is decomposed by sulphuric acid; it is a colorless, hot, sweet, volatile liquid of chloroformic odor.

**PROPERTIES AND USES.**—Anæsthetic for inhalation. Acts similarly to chloroform, but is possibly a better preparation.

**Ethyl Bromide. Æthylis Bromidum.**—Mono-bromo-ethane, Ether Bromatus, Hydrobromic Ether.



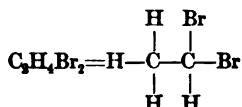
**Manufacture:** Distil alcohol (12) and sulphuric acid (7), gradually adding potassium bromide (12):



It is a colorless, light, refractive, mobile, heavy liquid, very volatile, sweet warm taste, chloroform-like odor, sp. gr. 1.445–1.450, boils at 39° C. (102° F.), miscible with alcohol, chloroform, ether, and oils, but not with water. Should be kept in the dark and in well-stoppered flasks, inasmuch as air and light decompose it into hydrobromic acid and bromine.

**PROPERTIES AND USES.**—Anæsthetic. It is rapid, transient, abolishing pain without loss of consciousness, depresses respiration, but is attended, as a rule, with no bad effects, as is chloroform. A few whiffs are generally sufficient to cause anæsthesia, which lasts sufficiently long for all minor surgical operations, as opening abscesses, boils, in dentistry, etc. In administering, hold the towel close to the mouth to prevent admission of air, and put the full quantity thereupon at once, which should be zij–6 (8–24 Cc.). With most anæsthetics the converse is the case. Administer on empty stomach, only one minute, do not reapply, and never use when lesions of heart, kidneys, or lungs are present.

**Ethylene Bromide. Æthylenum Bromatum.**—Brom-ethylene.



**Manufacture:** The unsaturated hydrocarbon ethylene ( $\text{C}_2\text{H}_4$ ) is passed into bromine until saturation is effected— $\text{C}_2\text{H}_4 + \text{Br}_2 = \text{C}_2\text{H}_4\text{Br}_2$ . It is

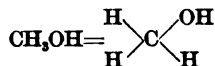
a colorless, strongly refracting liquid, sweet taste, chloroformic odor, sp. gr. 2.170, boils at 132° C. (269° F.). Dose, ℥ij-5 (.13-.3 Cc.).

PROPERTIES AND USES.—In epilepsy ; should not be confounded with ethyl bromide, owing to its more poisonous properties.

## II. Alcohols.

### 2. OXYGEN DERIVATIVES.

**Methyl Alcohol.** *Alcohol Methylicum.*—(Syn., Methyl Hydroxide, Wood Naphtha or Spirit, Pyroligneous Spirit or Alcohol ; Fr. Alcool (Esprit) de Bois.)



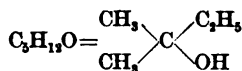
*Manufacture* : The aqueous portion of the distillate from the destructive distillation of wood contains 1 p. c., along with acetic acid, acetone, aldehyde, allyl alcohol, oils, etc. This lighter portion is saturated with chalk,  $\text{CaCO}_3$  (forming calcium acetate), then distilled, and all that comes over under 100° C. (212° F.) is crude wood spirit, which has to be rectified again over  $\text{CaCl}_2$  and  $\text{CaO}$ . It is a thin, colorless liquid, peculiar odor, burning taste, sp. gr. 0.802. A purified product, having less odor, under the name of *Columbian Spirit* is used largely in making external remedies and those from which it is reclaimed during manufacture.

PROPERTIES AND USES.—Mostly in the arts as a substitute for (ethyl) alcohol to dissolve resins, volatile oils, alkaloids, etc.

*Methylated Spirit* consists of ethyl alcohol 90 p. c. + methyl alcohol 10 p. c. This is used abroad as an alcoholic solvent, owing to its being free from internal revenue tax ; very poisonous.

**Ethyl Alcohol.** *Alcohol, C<sub>2</sub>H<sub>5</sub>OH.* (*Official.*) See page 814.

**Amylene Hydrate.** *Di-methyl-ethyl-carbinol.*—Tertiary Amyl Alcohol.



*Manufacture* : Impure amylene is treated with  $\text{H}_2\text{SO}_4$ , which forms amyl sulphuric acid ; this is diluted, filtered, neutralized with milk of lime or liquor sodii hydroxide, and then fractionally distilled. It is a clear, oily liquid of a peculiar penetrating odor resembling that of a mixture of camphor and peppermint, burning taste, sp. gr. 0.815, boils at 102.5° C. (216.5° F.), dissolves in 8 parts of water, miscible in all proportions with alcohol, chloroform, ether, benzin, fixed oils, and glycerin ; yields acetic acid on oxidation. Dose, ℥xv-45 (1-3 Cc.). May disagree with stomach, then give hypodermically.

PROPERTIES AND USES.—Hypnotic, anodyne. Has a power midway between hydrated chloral and paraldehyde. May be given in wine, fruit, syrup, or water.

## III. Aldehydes.

**Solution of Formaldehyde.** *Liquor Formaldehydi*,  $\text{CH}_2\text{O}$ .—(Official.) See page 819.

**Hexamethylenamine.** *Hexamethylenamina*. *Urotropine*,  $\text{C}_6\text{H}_{12}\text{N}_4$ .—(Official.) See page 820.

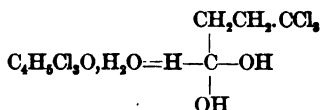
**Tannoform.** *Methylene Ditannin*,  $(\text{C}_{14}\text{H}_9\text{O}_9)_2\text{CH}_2$ .

*Manufacture*: Dissolve tannin 5 Gm., in hot water 15 Kg., add 30 p. c. formaldehyde 3 Kg., precipitate with hydrochloric acid 15 Kg., wash precipitate. There are several tannoforms, each differing only in the purified plant extract used containing the tannin. Tannoform is a light, pinkish-white powder, soluble in alcohol. Enteritis, diarrhœa, bedsores, fœtor o. feet and sweat, chancres, eczema, pruritus vaginæ. Dose, gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.).

**Paraldehyde.** *Paraldehydum*,  $\text{C}_6\text{H}_{12}\text{O}_3$ . (Official.) See page 820.

**Hydrated Chloral.** *Chloralum Hydratum*,  $\text{C}_2\text{HCl}_3\text{O}, \text{H}_2\text{O}$ .—(Official.) See page 821.

**Butyl-Chloral Hydrate.** *Butyl-Chloral Hydras*.—Chloral Butylicum, Croton-Chloral Hydrate (misnomer), Tri-chlor-butyl-aldehyde Hydrate.



*Manufacture*: Pass dry chlorine gas through (acetic) aldehyde, when butyl-chloral,  $\text{C}_4\text{H}_5\text{Cl}_3\text{O}$ , is formed, which being an oil is separated by fractional distillation; this then will unite with water to form a solid hydrate, and from this solution butyl-chloral hydrate crystallizes in white scales with a peculiar pungent, fruit-like odor, warm, bitter, nauseous taste; it is readily soluble in alcohol, ether, hot water, and glycerin, slightly in cold water, melts at  $78^\circ \text{C}$ . ( $172^\circ \text{F}$ .). Dose, gr. 5–30 (.3–2 Gm.), in pills or syrup. It is well to give gr. 3–5 (.2–.3 Gm.) every 2 hours until pain is relieved or sleep produced.

*Incompatibles*: All alkalies.

**PROPERTIES AND USES.**—Hypnotic. Similar to hydrated chloral, but is less certain, and by some claimed to be not so depressant to the heart. Good in facial neuralgia, migriane, headache, nausea, neuralgia, due to decayed teeth.

**Chloralformamide.** *Chloralformamidum*,  $\text{C}_2\text{HCl}_3\text{OH}, \text{NH}, \text{CHO}$ .—(Official.) See page 823.

**Chloralose.** *Anhydro-gluco-chloral*,  $\text{C}_8\text{H}_{11}\text{Cl}_3\text{O}_6$ .

*Manufacture*: Heat together equal quantities of anhydrous chloral and glucose at  $100^\circ \text{C}$ . ( $212^\circ \text{F}$ .) for at least an hour, treat the cooled mass with a little water, then boil with ether, distil the ether-soluble portion with water to remove chloral, then let crystallize; yield about 3 p. c. It occurs in small colorless crystals, bitter, disagreeable taste,

soluble in alcohol, ether, acetic acid, hot water, and slightly in cold water; melts at  $185^{\circ}\text{C}$ . ( $365^{\circ}\text{F}$ .). Dose, gr. 5–15 (.3–1 Gm.).

**PROPERTIES AND USES.**—Hypnotic; free from cumulative and cardiac after-effects. Causes profound sleep, in which sensibility is not lost; owing to its great bitterness should be given in capsules or cachets. Its poisonous effect resemble very much that of hydrated chloral.

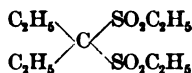
**Acetone. Acetonum.**  $(\text{CH}_3)_2\text{CO}$ .—(*Official.*) See page 829.

### 3. SULPHUR DERIVATIVES.

**Sulphonmethane. Sulphomethanum. Sulphonal,**  $(\text{CH}_3)_2\text{C}(\text{C}_2\text{H}_5\text{SO}_2)_2$ .—(*Official.*) See page 830.

**Sulphonethylmethane. Sulphonethylmethanum. Trional,**  $\text{CH}_3\text{C}(\text{C}_2\text{H}_5\text{SO}_2)_2\text{C}_2\text{H}_5$ .—(*Official.*) See page 830.

**Tetronal. Tetronalum.**—Diethyl-sulphon-diethyl-methane.



**Manufacture:** Like sulphonal, except that start with diethyl-ketone instead of acetone. It is in colorless, odorless, shining plates or laminae, soluble in alcohol, ether, hot water, and 450 parts cold water; melts at  $89^{\circ}\text{C}$ . ( $192^{\circ}\text{F}$ .). Dose, gr. 15–30 (1–2 Gm.).

**PROPERTIES AND USES.** Hypnotic. Similar to, but much less used than sulphonal and trional.

The three last compounds or sulphones depend upon the ethyl groups for hypnotic effects, the greater their number the more powerful the action.

### IV. Acids.

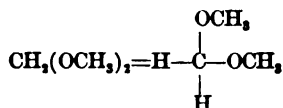
**Acetic Acid. Acidum Aceticum,**  $\text{C}_2\text{H}_4\text{O}_2$ . (*Official.*) See page 831.

**Trichloroacetic Acid. Acidum Trichloroaceticum,**  $\text{HC}_2\text{Cl}_3\text{O}_2$ .—(*Official.*)—See page 833.

**Lactic Acid. Acidum Lacticum,**  $\text{C}_3\text{H}_6\text{O}_3$ .—(*Official.*) See page 837.

### V. Ethers.

**Methylal.**—Methylene-dimethyl Ether.



**Manufacture:** Distil together methyl alcohol, sulphuric acid, and manganese dioxide, by which process the methyl alcohol is oxidized; caustic potash may be added to the distillate to separate the methyl

formate. This is a mobile, colorless, volatile liquid, odor like chloroform and acetic ether, burning, aromatic taste, soluble in alcohol, ether, oils, and 3 parts water, sp. gr. 0.855, boils at 42° C. (107.6° F.). Dose, ℥<sub>xxx</sub>-90 (2-6 Cc.), in emulsion, or syrup and water.

PROPERTIES AND USES.—Anæsthetic, hypnotic, narcotic; asthma, colic, angina, tetanus.

**Ethyl Ether.** *Æther*.—Ethyl Oxide, (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>O. (*Official.*) See page 838.

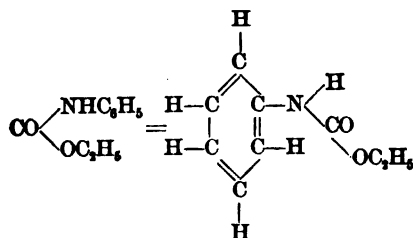
**Ethyl Nitrite.** Nitrous Ether, C<sub>2</sub>H<sub>5</sub>NO<sub>2</sub>.—(*Official.*) See page 841.

**Amyl Nitrite.** Amyl Nitris, C<sub>5</sub>H<sub>11</sub>NO<sub>2</sub>.—(*Official.*) See page 842.

#### 4. UREA DERIVATIVES.

**Ethyl Carbamate.** *Æthylis Carbamas.* Urethane, C<sub>2</sub>H<sub>5</sub>NH<sub>2</sub>-CO<sub>2</sub>.—(*Official.*) See page 843.

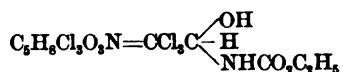
**Euphorin.** Phenyl Urethane.



*Manufacture:* By the interaction of chlor-ethyl-formate and aniline. It is a white crystalline powder, faint aromatic odor, clove-like after-taste, soluble in alcohol, ether, hydro-alcoholic solutions. Dose, gr. 2-10 (.13-.6 Gm.).

PROPERTIES AND USES.—Antipyretic, analgesic, antirheumatic; as a substitute for iodoform.

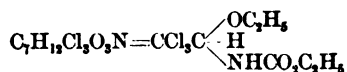
**Ural.** *Uralium*.—Chloral Urethane, Uraline.



*Manufacture:* Mix together hydrated chloral and urethane, on adding HCl they unite into a solid which is insoluble in cold water, treat with H<sub>2</sub>SO<sub>4</sub>, wash with water; this compound is decomposed by hot water into its two components, soluble in alcohol or ether. Dose, gr. 10-40 (.6-2.6 Gm.).

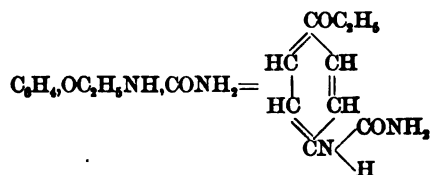
PROPERTIES AND USES.—Hypnotic; cough, angina, insomnia.

**Somnal.** Ethylated Chloral Urethane.



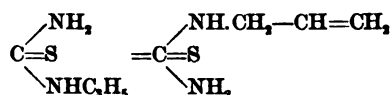
This is an alcoholic solution of ural, or a union of alcohol, hydrated chloral, and urethane. It is hypnotic in doses  $\text{M}_x-40$  (.6–2.6 Cc.).

**Sucrol. Dulcin.**—Para-phenetol-carbamide, Para-ethoxy-phenyl Urea.



**Manufacture:** Act upon para-phenetidine with carbonyl chloride to form dipara-phenetol-carbamide; heat this in steam digester with urea to  $160^\circ \text{C}$ . ( $320^\circ \text{F}$ .). This compound crystallizes from water in shining needles, sweet taste, soluble in 150 parts hot water, 800 cold water, 25 alcohol. It is 200 times sweeter than sugar, for which it is used in diabetes.

**Thiosinamin. Allyl-thio-urea.**—Allyl-sulpho-urea.

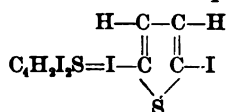


**Manufacture:** Act on allyl-sulphocyanate (mustard oil,  $\text{C}_3\text{H}_7\text{NCS}$ ) with ammonia. Occurs in colorless, rhombic crystals, bitterish, soluble in water, alcohol, ether, melts at  $74^\circ \text{C}$ . ( $165^\circ \text{F}$ .), garlic odor. Dose, gr.  $\frac{1}{2}$ –7 (.03–.5 Gm.), by injection, repeated every 3–4 days. Poisonous.

**PROPERTIES AND USES.**—Inject subcutaneously for lupus, tuberculous diseases; causes absorption of exudate, corneal opacities.

## 5. THIOPHENE DERIVATIVES = $\text{C}_4\text{H}_4\text{S}$ .

**Thiophene-Di-iodide.**—Di-iodo-thiophene.



**Manufacture:** By the action of iodine on thiophene ( $\text{C}_4\text{H}_4\text{S}$ , a product from benzene) in the presence of mercuric oxide. It is in colorless, volatile crystals, aromatic odor, soluble in ether, chloroform, hot alcohol, insoluble in water; melts at  $40.5^\circ \text{C}$ . ( $104.9^\circ \text{F}$ .); contains 75.5 p. c. iodine and 9.5 p. c. sulphur.

**PROPERTIES AND USES.**—Antiseptic. As a substitute for iodoform.

**Sodium Thiophene-sulphonate**,  $\text{C}_4\text{H}_3\text{S}_2\text{SO}_3\text{Na}$ .—This is a white crystalline powder, containing 33 p. c. sulphur, with a feeble, disagreeable odor, and used like the preceding.

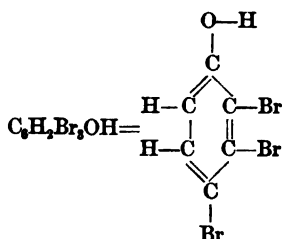
II. AROMATIC (BENZENE) SERIES,  $C_6H_6$ .

(CLOSED-CHAIN COMPOUNDS.)

## 6. TERPENES.

**Terebene.** Terebenum,  $C_{10}H_{16}$ .—(*Official.*) See pages 71–72.**Terpin Hydrate.** Terpini Hydras,  $C_{10}H_{16}3H_2O$ .—(*Official.*) See pages 71–72.

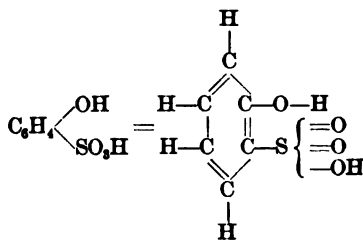
## 7. PHENOL DERIVATIVES.

**Phenol.** Acidum Carbolicum,  $C_6H_5OH$ .—(*Official.*) See page 845.**Menthol.** Menthol,  $C_{10}H_{20}O$ .—(*Official.*) See page 530.**Bromol.** Tri-bromo-phenol.—Tri-brom-phenol.

*Manufacture*: Act on phenol with bromine; thus  $C_6H_5OH + 6 Br = C_6H_2Br_3OH + 3HBr$ . It is a colorless crystalline powder, soluble in alcohol, chloroform, ether, fixed or volatile oils, insoluble in water; melts at  $95^\circ \text{C}$ . ( $203^\circ \text{F}$ .); odor unpleasant, taste sweetish, astringent. Dose, gr. 1–8 (.06–.5 Gm.).

**PROPERTIES AND USES.**—Antiseptic, disinfectant, caustic; tuberculous ulcers, gangrene, diphtheria, cholera infantum.

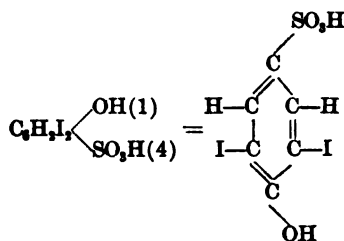
**Aseptol.** Ortho-phenol Sulphonic Acid.—Sozolic Acid, Sulpho-(carbol) phenol.



*Manufacture*: Mix phenol and sulphuric acid at a very low temperature, allowing to stand several days; this product is purified by converting it into the barium salt and precipitating barium with  $H_2SO_4$ . It is a solution containing 33 p. c. ortho-phenol-sulphonic acid, having a sour taste, acid reaction, and phenol-like odor.

**PROPERTIES AND USES.**—Antiseptic. Like phenol (carbolic acid), but possesses only one-third its antiseptic power.

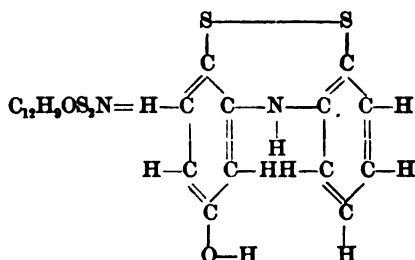
**Soziodol. Soziodolic Acid.**—Di-iodo-para-phenyl-sulphonic acid.



*Manufacture:* Phenol (2 parts) and sulphuric acid (1) are heated together for 3 days at 110° C. (230° F.), forming para-phenol-sulphonic acid, and this is treated with iodine. The compound crystallizes from water in needle-shaped prisms that are soluble in alcohol or water; contains iodine 54 p. c., phenol 20 p. c., sulphur 7 p. c.

**PROPERTIES AND USES.**—Antiseptic in 2–3 p. c. solutions. The metallic salts which this acid forms are good substitutes for iodoform, those with sodium being preferred.

**Sulphaminol. Thio-oxy-diphenylamine.**



*Manufacture:* Boil together meta-oxy-diphenylamine, sodium hydroxide solution, and sulphur, treat filtered solution with ammonium chloride. It occurs as a yellow, odorless, tasteless powder, soluble in alkalis, insoluble in water; melts at 155° C. (311° F.).

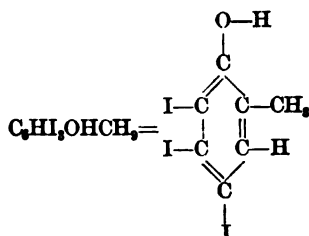
**PROPERTIES AND USES.**—Antiseptic. As a substitute for iodoform.

**Lysol. Lysolum.**—Made by reserving distillate from the coal-tar oil that comes over between 190–200° C. (374–392° F.), which is boiled in fat until dissolved, then saponified with alcohol (or alkali). It is a brown, oily-looking, clear liquid, aromatic odor resembling cresote; contains 50 p. c. of cresol; it is soluble in water, forming clear, frothing, saponaceous liquid, also in alcohol, chloroform, or glycerin.



**PROPERTIES AND USES.**—Antiseptic in surgery, gynecology. It is 5 times stronger, but only one-eighth as poisonous as phenol (carbolic acid), and one-half as poisonous as creolin. Useful in skin diseases, lupus, diphtheria, gargle for foul breath. Should be applied in aqueous solution (1–3 p. c.).

**Losophane. Tri-iodo-meta-cresol.**—



**Manufacture:** Add aqueous solution of iodine and potassium iodide slowly, with stirring, to solution of ortho-oxyparatoluic acid in sodium bicarbonate and water, after 24 hours wash precipitate with water, crystallize from alcohol. It is in colorless, odorless needles, slightly acid, soluble in benzene, chloroform, ether, diluted NaOH, slightly in alcohol, insoluble in water, decomposed by strong caustic soda; melts at 122° C. (251° F.); contains iodine 78.39 p. c.

**PROPERTIES AND USES.**—Antiseptic. In parasitic skin affections, eczema, prurigo. Apply in 1–2 p. c. solutions of alcohol 3 vols. + water 1, or in 1–10 p. c. ointments of vaseline or wool-fat.

**Thymolis Iodidum. Thymol Iodide. Aristol,  $\text{C}_{20}\text{H}_{24}\text{O}_2\text{I}_2$ .**—(Official.) See page 852.

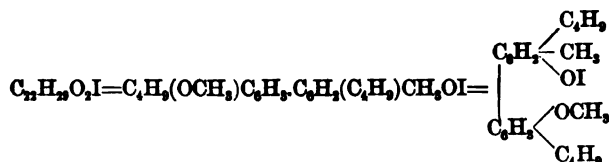
**Ichthyolum. Ichthyol,  $\text{C}_{28}\text{H}_{36}\text{S}_3\text{O}_6(\text{NH}_4)_2$ .**—Ammonium-sulpho-ichthyolate, Ammonium-ichthyol-sulphonate.

**Manufacture:** This is a crude oil obtained by the destructive distillation of a European bituminous rock containing petrified fossil remains of fish and other animals. This oil when saturated with  $\text{H}_2\text{SO}_4$ , becomes heated to 100° C. (212° F.), forming ichthyol-sulphonic acid with evolution of  $\text{SO}_2$ ; treat now with NaOH (or NaCl) solution to remove  $\text{H}_2\text{SO}_3$  and  $\text{H}_2\text{SO}_4$ , saturate residue with ammonia. It is a viscous, reddish-brown, syrupy liquid, bituminous odor and taste, soluble in water, glycerin, fats. Dose, gr. 10–20 (.6–1.3 Gm.), ter die.

*Sodium-sulpho-ichthyolate* is the most important salt for administering in pill-form, although we have the corresponding salts of lithium, zinc, and mercury. All of these are obtained by saturating the acid with the respective oxides or carbonates.

**PROPERTIES AND USES.**—Alterative, anodyne, discutient; chronic rheumatism, gout, lepra, eczema, urticaria, acne, intertrigo, lupus, ulcers, lymphatic enlargements, burns, frostbites, sprains, contusions, psoriasis, prostatitis. Give in pill, or apply ointment (20–50 p. c.) with wool-fat.

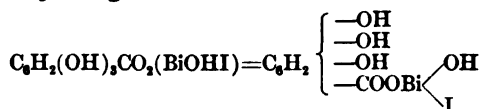
**Europhen.** Di-iso-butyl-ortho-cresol-iodide.



**Manufacture:** Europhen is made like aristol, but iso-butyl-ortho-cresol is used instead of thymol. It is an amorphous golden-yellow powder, saffron-like odor, 5 times as bulky as iodoform, soluble in alcohol, ether, chloroform, 4 parts olive oil, insoluble in water or glycerin; melts at 110° C. (230° F.), forming a clear brown liquid; contains iodine 28 p. c. Dose, gr.  $\frac{1}{2}$ –2 (.03–.13 Gm.).

**PROPERTIES AND USES.**—Antiseptic, germicide, bactericide. Possesses about the same power, and used like iodoform for wounds, ulcers, burns, psoriasis, eczema, lupus, chancres, rhinitis, in ointment.

**Bismuth Oxyiodogallate.** Airol.—



**Manufacture:** By combining basic bismuth, oxygen, and iodine. It is a grayish-green, odorless, tasteless powder, turning red by moisture, thereby losing iodine; contains  $\text{Bi}_2\text{O}_3$  44.5 p. c., iodine 24.8 p. c.

**PROPERTIES AND USES.**—Antiseptic; good substitute for iodoform; abscesses, burns, chancres, metritis, rhinitis, vaginitis, ulcers; in powder, ointment (10–20 p. c.) with lard, vaselin, glycerin.

**Bismuth Tribromophenol, Xeroform,**  $(\text{C}_6\text{H}_2\text{Br}_3\text{O})_2\text{BiOH} + \text{Bi}_2\text{O}_3$ .

**Manufacture:** By combining chemically equal quantities of bismuth and tribromophenol. It is a yellowish-green, odorless, tasteless, insoluble powder; contains  $\text{Bi}_2\text{O}_3$  50 p. c. Intestinal antiseptic; acute and chronic enteritis, burns, infected wounds, ulcers; in place of iodoform.

**Antiseptin.** Boro-thymol Zinc Iodide.

**Manufacture:** This is a mixture of zinc sulphate 85 parts, zinc iodide 2.5, thymol 2.5, boric acid 10. Antiseptic for wounds, ulcers, etc.

## 8. DI-HYDROXY PHENOL DERIVATIVES.

**Guaiacol.** Guaiacol. Guaiacolum,  $\text{C}_7\text{H}_8\text{O}_2$ .—(Official.) See page 850.

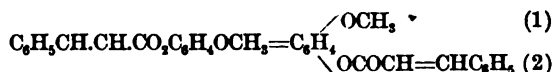
**PREPARATIONS.**—1. *Guaiacolis Carbonas*,  $(\text{C}_6\text{H}_4\text{OCH}_3)_2\text{CO}_2$ .—(Official.) See page 851.

2. *Guaiacolis Benzoas*. Guaicol Benzoate, Benzosol, Benzoyl Guaiacol,  $\text{C}_6\text{H}_4\text{OHC}_6\text{H}_5\text{CO}_2$ .

**Manufacture:** Act on the potassium salt of guaiacol with benzoyl chloride. It is a colorless crystalline powder, odorless, tasteless, soluble in alcohol, chloroform, ether, insoluble in water; melts at

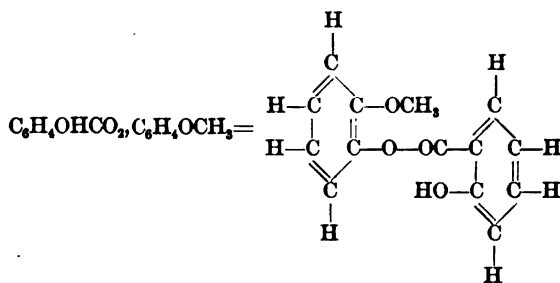
56° C. (133° F.); alcoholic solution of potassium hydroxide saponifies it, sulphuric acid turns it lemon-yellow, but ferric chloride produces no color in alcoholic solutions. Dose, gr. 5–30 (.3–2 Gm.).

3. *Guaiacolis Cinnamas*. Guaiacol Cinnamate, Styrcol, Cinnamyl Guaiacol.



*Manufacture*: Act on guaiacol with cinnamyl-chloride by heating on water-bath, crystallize from boiling alcohol. It is in white needle crystals, soluble in ether, chloroform, insoluble in water. Dose, gr. 2–10 (.13–.6 Gm.).

4. *Guaiacolis Salicylas*. Guaiacol Salicylate, Guaiacol Salol.



*Manufacture*: Act on a mixture of sodium-guaiacol and sodium salicylate with phosphorus oxychloride. It is a white crystalline powder, analogous to salol, soluble in alcohol, chloroform, ether, insoluble in water. Dose, gr. 5–30 (.3–2 Gm.).

**PROPERTIES AND USES.**—For the same purposes as creosote, but is less valuable, it is also less irritating to the intestinal canal and kidneys; phthisis, external tubercle, lupus, cough, expectoration, antiseptic. The benzoate splits in the system into guaiacol and benzoic acid, and so possibly do the others separate into their original components; the cinnamate is useful in gleet, vesical catarrh, diarrhoea.

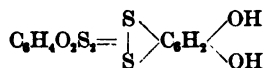
**Eugenol.** **Eugenol.** **Eugenic Acid,**  $\text{C}_{10}\text{H}_{12}\text{O}_2$ —(*Official.*) See page 435.

**Eugenol Acetamide,**  $\text{C}_{10}\text{H}_{11}\text{O}_2\text{COCH}_2\text{NH}_2$ .

*Manufacture*: Act on chloracetic acid with the sodium salt of eugenol, producing eugenol acetic acid; this being changed to the ethyl-ester is treated with alcoholic ammonia, giving thus the amide. It crystallizes in fine needles, melts at 110° C. (230° F.).

**PROPERTIES AND USES.**—Anæsthetic, antiseptic, similar to cocaine; dentistry, etc.

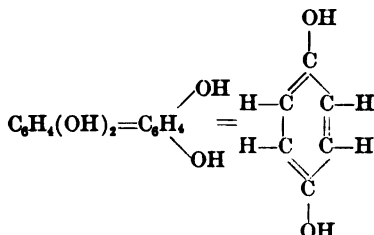
**Resorcinol.** **Resorcinol.**—Resorcinum, Resorcin, Meta-di-hydroxy-benzene. (*Official.*) See page 852.

**Thioresorcin.**

*Manufacture:* Heat resorcin (1), sodium hydroxide (3), and sulphur (3) with water until solution effected, acidify the solution to get flocculent precipitate, dry. It is a yellowish amorphous powder, soluble in alkalis, carbonates, and sulphides, insoluble in ordinary reagents.

**PROPERTIES AND USES.**—Antiseptic, similar but inferior to iodoform.

**Hydroquinone. Hydrochinone. Quinol.**—Hydroquinol, Para-di-hydroxy-benzene.



*Manufacture:* Oxidize aniline with potassium dichromate and sulphuric acid, then reduce the resulting quinone ( $\text{C}_6\text{H}_4\text{O}_2$ ) with acid sodium sulphite (sulphurous acid). It crystallizes from water in hexagonal prisms, which heated sublime undecomposed; soluble in alcohol, ether, hot water, slightly in cold water, melts at  $169^\circ \text{C}$ . ( $336^\circ \text{F}$ .), it reduces  $\text{AgNO}_3$  solution on warming, and Fehling's solution at ordinary temperature. Dose, gr. 10–20 (.6–1.3 Gm.).

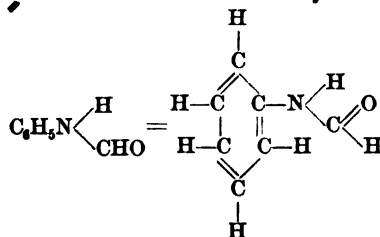
**PROPERTIES AND USES.**—Antipyretic, antiseptic; fevers of phthisis and pneumonia.

**Pyrogallol. Pyrogallic Acid.**—Tri-hydroxy-benzene,  $\text{C}_6\text{H}_3\text{O}_3$ . (*Official.*) See page 157.

## 9. BENZENE DERIVATIVES CONTAINING NITROGEN. AMIDO DERIVATIVES.

The best known amine of this series is aniline,  $\text{C}_6\text{H}_5\text{NH}_2$ . In aniline the ammonia residue,  $\text{NH}_2$ , replaces 1 of the hydrogen atoms in benzene ( $\text{C}_6\text{H}_6$ ); these hydrogen atoms in  $\text{NH}_2$  may be replaced by hydrocarbon or acid residues.

**Formanilide. Formanilidum.**—Phenylformamide.

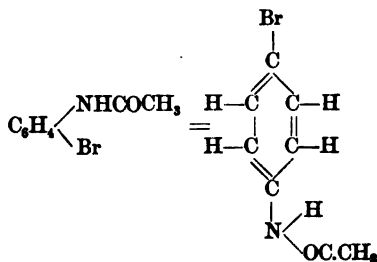


**Manufacture:** Distil a mixture of aniline and oxalic acid (formic acid)— $C_6H_5HN_2 + H_2C_2O_4 = C_6H_5NHC(=O)OH + CO_2 + H_2O$ . It is in colorless prismatic needles or crystals, soluble in alcohol, partially in water, melts at  $46^\circ C.$  ( $115^\circ F.$ ), diluted acids decompose it into aniline and formic acid. Dose, gr. 2–5 (.13–.3 Gm.).

**PROPERTIES AND USES.**—Antipyretic, antineuralgic, analgesic.

**Acetanilidum. Acetanilide.**—Antifebrin,  $C_8H_9NO$ . (*Official.*) See page 856.

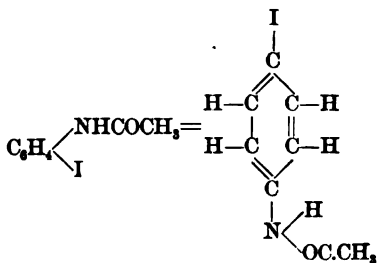
**Antisepsin. Asepsin.**—Acetbromanilide, Para brom-acetanilide.



**Manufacture:** To a solution of acetanilide in acetic acid add bromine. The product is purified by crystallization from alcohol. It is in colorless, monoclinic prisms, soluble in alcohol, insoluble in water, melts at  $166^\circ C.$  ( $331^\circ F.$ ). The ortho-compound is more soluble in alcohol, melts at  $99^\circ C.$  ( $210^\circ F.$ ). Dose, gr. 3–8 (.2–.5 Gm.), ter die.

**PROPERTIES AND USES.**—Antiseptic, antipyretic, analgesic; typhoid fever, pneumonia, phthisis; locally to wounds, bites.

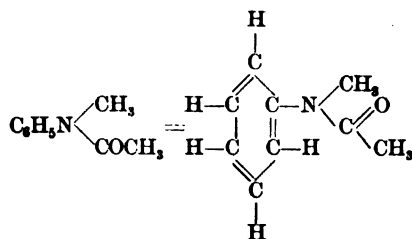
**Iodoacetanilide. Iodoantifebrin.**—Para-iodo-acetanilide.



**Manufacture:** Heat together acetic acid and para-iodo-aniline. It is in colorless, rhombic tablets, odorless, tasteless, soluble in alcohol, acetic acid, hot water, slightly in cold water, melts at  $181^\circ C.$  ( $358^\circ F.$ ). Dose, gr. 1–5 (.06–.3 Gm.).

**PROPERTIES AND USES.**—Antipyretic, analgesic, anodyne.

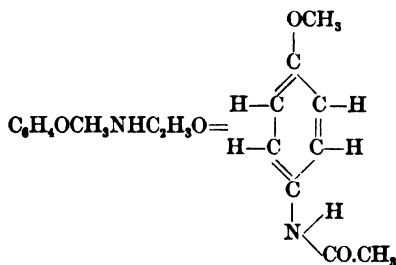
**Methylacetanilide. Methylacetanilidum.**—Exalgine, Methyl-phenyl-acetamide, Acetmethyl-anilide.



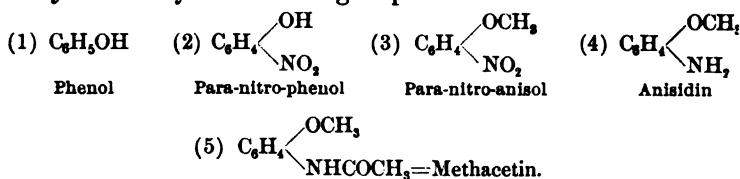
**Manufacture:** Act on mono-methyl-aniline ( $\text{C}_6\text{H}_5\text{N} \begin{smallmatrix} \text{CH}_3 \\ \text{H} \end{smallmatrix}$ ) with acetylchloride. Methylacetanilide is in needles, or in long, tablet-like crystals, soluble in alcohol, slightly so in water, melts at  $102^\circ \text{C}$ . ( $215^\circ \text{F}$ ). Dose, gr. 1-5 (.06-.3 Gm.).

**PROPERTIES AND USES.**—Antineuralgic, analgesic, antiseptic; neuralgia, chorea, rheumatism, sciatica, superior to antipyrine.

**Methacetin. Para-acetanilidin.**—Para-oxy-methyl-acetanilide.



**Manufacture:** by the following steps:



This approximates closely to phenacetin; occurs in colorless, odorless scales, soluble in alcohol, acetone, glycerin, fatty oils, slightly in water, benzene, and ether. Dose, gr. 2-8 (.13-.5 Gm.).

**PROPERTIES AND USES.**—Antipyretic; typhoid, rheumatism.

**Acetphenetidid. Acetphenetidinum. Phenacetin,**  $\text{C}_6\text{H}_4.\text{OC}_2\text{H}_5.-\text{NHC}_2\text{H}_5\text{O}$ .—(*Official.*) See page 858.

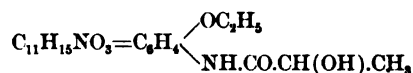
**Holocaine. Holocainum.**—Para-diethoxyethenyl-diphenylamidine,  $\text{OC}_2\text{H}_5.\text{C}_6\text{H}_4.\text{NHC}.\text{CH}_3.\text{N}.\text{C}_6\text{H}_4.\text{O}.\text{C}_2\text{H}_5 + \text{H}_2\text{O}$ .

**Manufacture:** May be obtained by combining in molecular quantities phenacetin and para-phenetidid, when water separates, leaving the base— $\text{OC}_2\text{H}_5.\text{C}_6\text{H}_4.\text{NHC}.\text{O}.\text{CH}_3 + \text{H}_2\text{N}.\text{C}_6\text{H}_4.\text{O}.\text{C}_2\text{H}_5 = \text{OC}_2\text{H}_5.\text{C}_6\text{H}_4.\text{NHC}.\text{CH}_3.\text{N}.\text{C}_6\text{H}_4.\text{O}.\text{C}_2\text{H}_5 + \text{H}_2\text{O}$ . It occurs in beautiful white needles, which melt at  $120^\circ \text{C}$ . ( $248^\circ \text{F}$ ), soluble in 40 parts water, undecom-

posed by boiling, which should be accomplished in a porcelain vessel, as the solutions attack glass. The hydrochloride, in white crystals, is the salt mostly used, in 1 p. c. solution; it is slightly bitter, neutral, and may be kept for months without change.

**PROPERTIES AND USES.**—Local anæsthetic, germicide, antiseptic, as a substitute for cocaine in ocular surgery. The anæsthesia is produced within a minute and lasts for a quarter of an hour, the burning being about as intense as that following cocaine. Unlike cocaine, it does not change the pupil, the accommodation, or intraocular pressure, does not contract bloodvessels, and additionally acts as an antiseptic. The disadvantages are that it requires to be renewed in 10 to 15 minutes, and is 5 times more toxic than cocaine, hence cannot be used hypodermically; 1 p. c. solution causes a degree of anæsthesia equal to a 3–4 p. c. solution of cocaine.

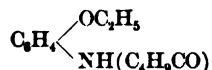
**Lactophenin.** **Lactopheninum.**—Lactyl-phenetidine.



**Manufacture:** Allow lactic acid to act on phenetidine in the presence of dehydrating substances. It is more soluble than phenacetin, and differs from it only in using lactic instead of acetic acid; occurs as a bitter, odorless, crystalline powder, soluble in 9 parts alcohol, 320 water, melts at 118° C. (244° F.). Dose, gr. 8–15 (.5–1 Gm.).

**PROPERTIES AND USES.**—Antipyretic, sedative, analgesic, hypnotic (between sulphonal and urethane); better tolerated than antipyrine, occasioning neither collapse nor cyanosis; rheumatism, pneumonia, typhoid and scarlet fevers, influenza, septicæmia.

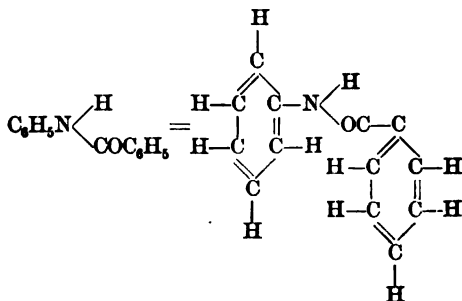
**Sedatin.** **Para-valeryl-amido-(phenetol) phenetidin.**



**Manufacture:** Act on para-amido-phenetol with valeric (valerianic) acid or valeryl chloride. It crystallizes in needles, slightly soluble in acetone, chloroform, ether, insoluble in water. Dose, gr. 1–5 (.06–.3 Gm.).

**PROPERTIES AND USES.**—Resembles antipyrine; sedative, anti-neuralgic.

**Benzanilide.** **Benzoyl-anilide.**—Phenylbenzamide.



**Manufacture:** Act on aniline with benzoyl chloride in the presence of caustic soda. It is in colorless scales, soluble in 58 parts of cold, 7 of hot alcohol, insoluble in water; melts at 162° C. (324° F.).

Benzanilide bears the same relation to benzoic acid that acetanilide does to acetic acid. Dose, gr. 2-8 (.13-.5 Gm.); children gr. 1-5 (.06-.3 Gm.).

**PROPERTIES AND USES.**—Antipyretic, especially in fevers of children.

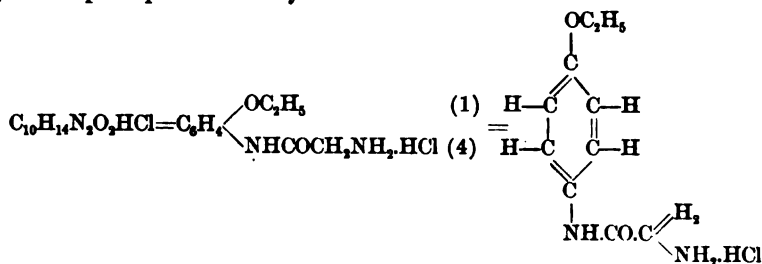
**Gallanilide. Gallanol.—Gallinol.**



**Manufacture:** By heating aniline to 150° C. (302° F.) for an hour with tannic or gallic acid ( $\text{C}_6\text{H}_2(\text{OH})_3\text{COOH}$ ); the resulting product is purified by crystallization from diluted alcohol. In colorless, bitter crystals, when free from water melts at 205° C. (401° F.), soluble in hot water, alcohol, ether, or alkalis, slightly in cold water.

**PROPERTIES AND USES.**—Chiefly externally for skin diseases, instead of chrysarobin.

**Phenocoll Hydrochloride. Phenocollum Hydrochloridum.—Glycocoll-para-phenetid in hydrochloride.**

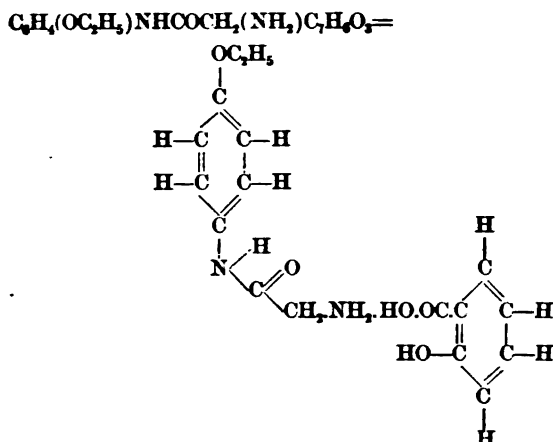


**Manufacture:** Chlor-acetyl chloride acts on para-amido-phenetol, and the resulting product is treated with ammonia. This is a result of many attempts to form a soluble phenacetin; it is a white crystalline powder, soluble in 20 parts water. When boiled with acids or alkalis it is broken up into phenacetin and glycocoll, and this latter base is always precipitated upon adding ammonia, alkalis, or alkaline carbonates to any of its solutions. Dose, gr. 5-15 (.3-1 Gm.), in capsules.

**PROPERTIES AND USES.**—Antipyretic, antineuralgic, antirheumatic, diaphoretic; hectic fever, chronic and acute rheumatism, neuralgia, hypnotic.

**Phenocoll Salicylate. Phenocollum Salicylicum.—Salocoll.**

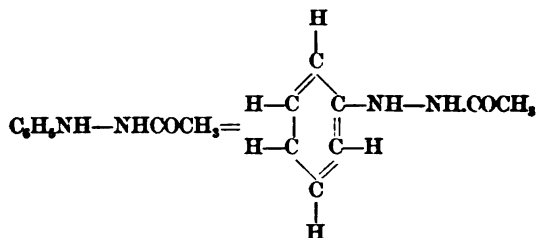




This is soluble in hot water, from which it crystallizes in fine needles; its aqueous solution is neutral in reaction and has a sweet taste. Dose, gr. 5-15 (.3-1 Gm.).

PROPERTIES AND USES.—Antipyretic, antirheumatic; combines those of phenocoll and salicylic acid.

**Hydracetin. Pyrodin.**—Acetyl-phenyl-hydrazine.

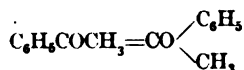


*Manufacture:* Heat together acetic anhydride, or acetic acid and phenyl-hydrazine, dissolve in boiling water, crystallize. It is in colorless, shining, odorless, tasteless crystals, soluble in alcohol, hot water; melts at 128° C. (263° F.); when boiled with HCl splits into acetic acid and phenyl-hydrazine hydrochloride. Dose, gr.  $\frac{1}{8}$ -1 (.01-.06 Gm.), ter die.

PROPERTIES AND USES.—Antipyretic, antineuralgic; hectic fever of phthisis, night-sweats. Externally—allied in effect to pyrogallol and chrysarobin in skin diseases (psoriasis, etc.). Apply in ointment 5-10 p. c.; when stronger may poison the system by absorption.

## VI. Aldehydes and Ketones.

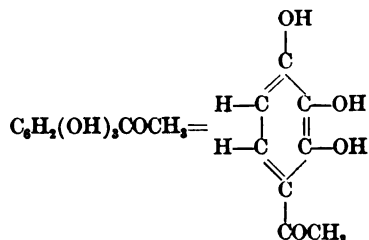
**Hypnone. Acetophenone.**—Phenyl-methyl-ketone.



**Manufacture:** 1. Distil a mixture of calcium acetate and benzoate. 2. Act on benzene in the presence of  $\text{AlCl}_3$  with acetyl chloride. It is in white crystals, melting at  $20^\circ \text{C}$ . ( $69^\circ \text{F}$ ). When in liquid form it is slightly yellow, bitter-almond odor, bitter taste, hence objectionable to some. Dose, gr. or  $\text{Mv}$ -15 (.3-1 Cc. or Gm.), which must be largely increased upon usage.

**PROPERTIES AND USES.**—Hypnotic, but somewhat uncertain.

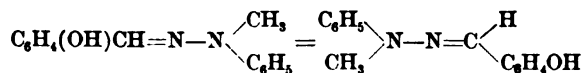
**Gallacetophenone. Tri-oxy-acetophenone.—Alizarin Yellow.**



**Manufacture:** Heat to  $145\text{--}150^\circ \text{C}$ . ( $293\text{--}302^\circ \text{F}$ .) for a short time a mixture of 1 part pyrogallol and  $1\frac{1}{2}$  parts each of zinc chloride and glacial acetic acid, to this hot fused mass add water, when gallacetophenone will separate out, which may be purified by crystallizing from hot water. It occurs in dirty, flesh-color, powdery crystals, soluble in alcohol, ether, glycerin, hot water, or 600 parts cold water.

**PROPERTIES AND USES.**—Antiseptic; skin affections (psoriasis, etc.), in 10 p. c. solutions or ointments, being a good substitute for pyrogallol, as it does not stain nor poison so easily.

**Agathin. Salicyl Aldehyde-methyl-phenyl-hydrazine.**



**Manufacture:** By the direct union of methyl-phenyl-hydrazine and salicylic aldehyde. It is in small greenish crystals, soluble in alcohol, benzene, ether, insoluble in water. Dose, gr. 5-10 (.3-.6 Gm.).

**PROPERTIES AND USES.**—Antineuralgic; neuralgia, rheumatism.

## 8. CARBOXYL DERIVATIVES ( $\text{CO}_2\text{H}$ ).

**Benzoic Acid. Acidum Benzoicum,  $\text{C}_7\text{H}_6\text{O}_2$ . (Official.)** See page 475.

**Benzosulphinide. Benzosulphinidum, Saccharin,  $\text{C}_6\text{H}_4 \begin{smallmatrix} \text{SO}_2 \\ \diagup \quad \diagdown \end{smallmatrix} \text{NH}$ .**—(Official.) See page 859.

## 9. OXYBENZOIC (SALICYLIC) DERIVATIVES.

**Salicylic Acid.** Acidum Salicylicum,  $C_7H_6O_3$ . (*Official.*) See page 466.

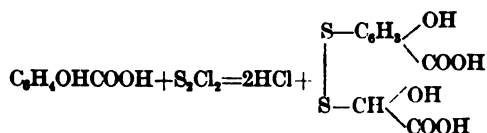
**Methyl Salicylas.** Artificial Oil of Wintergreen,  $C_6H_4 \begin{matrix} \text{OH} \\ \text{COOCH}_3 \end{matrix}$ . (*Official.*) See page 466.

**Di-odo-salicylic Acid,**  $C_6H_2I_2(OH)COOH$ .

*Manufacture:* To an alcoholic solution of salicylic acid add iodine and iodic acid. Occurs as a crystalline powder, sweetish taste, melts at  $220-230^\circ \text{C}$ . ( $428-446^\circ \text{F}$ .) with decomposition, soluble in alcohol, ether, 660 parts boiling water, 1,500 cold water. Dose, gr. 5-20 (.3-1.3 Gm.).

**PROPERTIES AND USES.**—Analgesic, antiseptic, antipyretic.

**Sodium di-thio-salicylate.**



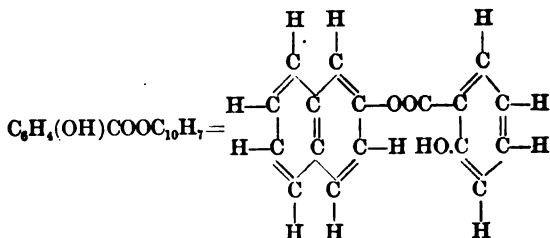
*Manufacture:* Heat together salicylic acid and sulphur chloride. It is a gray, hygroscopic, amorphous powder, soluble in water. Dose, gr. 5-15 (.3-1 Gm.).

**PROPERTIES AND USES.**—Antiseptic, antipyretic, analgesic.

**Phenyl Salicylate.** Phenylis Salicylas. Salol,  $C_6H_5C_7H_5O_3$ .—(*Official.*) See page 853.

**Meta-cresalol,**  $C_6H_4(OH)CO_2C_6H_4CH_3$ , and **Para-cresalol,**  $C_6H_4(OH)CO_2C_6H_4CH_3$ , are made by condensation of salicylic acid with either meta- or para-cresol. Both occur in colorless, odorless, tasteless crystals, and are used like salol. Dose of either, gr. 5-30 (.3-2 Gm.).

**Betol.** Naphtho-salol.—Naphthyl Salicylate, Salinaphthol.

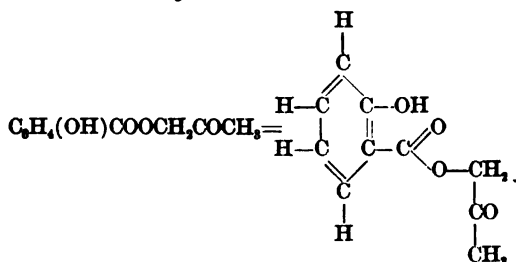


*Manufacture:* By replacing a hydrogen atom in salicylic acid by naphthol group ( $C_{10}H_7$ ), instead of phenol group ( $C_6H_5$ ) as in salol. Heat together beta-naphthol sodium, sodium salicylate, and phosphorus oxychloride. It is a white, tasteless, inodorous, crystalline powder,

soluble in boiling alcohol, ether, benzene, warm fixed oils, insoluble in water or glycerin. Dose, gr. 2-5 (.13-.3 Gm.).

**PROPERTIES AND USES.**—Intestinal antiseptic; articular rheumatism, vesical catarrh, cystitis; instead of salol.

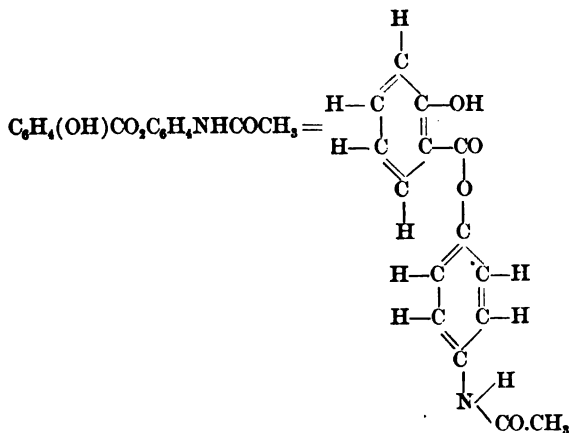
**Salacetol. Acetol Salicylate.**



**Manufacture:** Differs from salol in replacing the phenol group ( $\text{C}_6\text{H}_5$ ) by acetone radical ( $\text{CH}_2-\text{CO}-\text{CH}_3$ ). Heat together sodium salicylate and mono-chlor-acetone— $\text{C}_6\text{H}_4(\text{OH})\text{COO}[\text{Na} + \text{Cl}]\text{CH}_2-\text{COCH}_3 = \text{NaCl} + \text{C}_6\text{H}_4(\text{OH})\text{COOCH}_2\text{COCH}_3$ . Occurs in needle crystals, bitter taste, melts at  $71^\circ \text{C}$ . ( $160^\circ \text{F}$ .), soluble in 15 parts alcohol, 25 castor oil, 30 olive oil, 2,200 water. Dose, gr. 15-30 (1-2 Gm.).

**PROPERTIES AND USES.**—Similar to salol; rheumatism, diarrhoea.

**Salophen. Salophenum.**—Acetyl-para-amido-phenolsalicylate, Acetparamidophenol-salicylsäureester, Acetparamidosaloi.

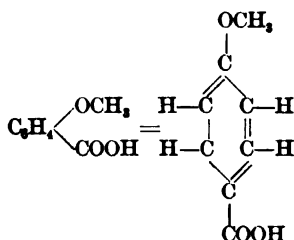


**Manufacture:** By a complicated process resembling somewhat that for salol—para-nitro-phenol-salicylate ( $\text{C}_6\text{H}_4(\text{OH})\text{COOC}_6\text{H}_4\text{NO}_2$ ) is formed by condensation of salicylic acid and para-nitro-phenol; this upon reduction gives para-amido-phenol-salicylate ( $\text{C}_6\text{H}_4(\text{OH})\text{COOC}_6\text{H}_4\text{NH}_2$ ), and this acted on by acetic acid gives salophen. It is in white scales, odorless, tasteless, soluble in alcohol, ether, alkalis, insoluble in water, melts at  $188^\circ \text{C}$ . ( $370^\circ \text{F}$ .); contains 51 p. c. of salicylic acid. Dose, gr. 5-15 (.3-1 Gm.).

**PROPERTIES AND USES.**—Antiseptic, antipyretic. As a substitute for salol or salicylic acid in acute articular rheumatism, also as an intestinal antiseptic. It is much safer and equally as efficient as salol.

#### 10. PARA-OXYBENZOIC DERIVATIVES.

**Anisic Acid. Methyl-para-oxy-benzoic Acid.**



**Manufacture:** 1. By the oxidation of para-cresyl-methyl ether. 2. By heating methyl iodide with potassium para-oxy-benzoate. 3. By the oxidation of anethol. It is a light, colorless crystalline powder, soluble in alcohol, ether, slightly in water; melts at  $184^\circ \text{C}$ . ( $363^\circ \text{F}$ .), boils at  $277^\circ \text{C}$ . ( $530^\circ \text{F}$ .). Dose, gr. 2–5–10 (.13–.3–.6 Gm.).

**PROPERTIES AND USES.**—Antiseptic, antirheumatic, neuralgia, acts like salicylic acid; usually given as sodium anisate.

**Orthoform. Orthoformum.**—Methyl-para-amido-meta-oxybenzoate.



This is a permanent, colorless, odorless, tasteless, crystalline powder, slightly soluble in water; the chloride quite soluble, but so acid as often to preclude its use. Dose, gr. 5–10 (.3–.6 Gm.).

**PROPERTIES AND USES.**—Local anæsthetic, analgesic, antiseptic. Has no action on sound mucous membranes or unbroken skin, and serves best as a dusting-powder to painful abrasions, burns, ulcers, or to gastric cancers and ulcers. Anæsthesia is induced as quickly as by cocaine, and is more persistent (many hours to several days), owing to the feeble solubility and tardy elimination of the drug, but it does not penetrate the tissues to the same extent, benumbing only those nerve-ends with which it comes in direct contact. May apply 5 p. c. solution of the chloride in diluted alcohol, and 10–20 p. c. ointments.

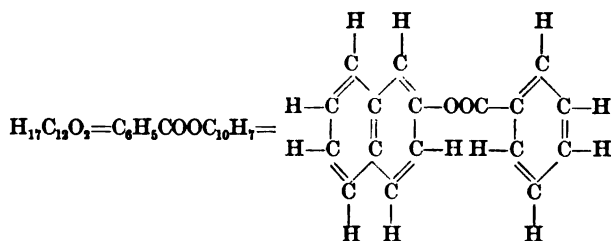
**Camphoric Acid. Acidum Camphoricum,  $\text{C}_{10}\text{H}_{16}\text{O}_4$ .**—(*Official*.) See page 234.

#### 11. NAPHTHALENE DERIVATIVES.

**Naphthalene. Naphthalenum,  $\text{C}_{10}\text{H}_8$ .**—(*Official*.) See page 854.

**Betanaphthol. Betanaphthol. Naphtol,  $\text{C}_{10}\text{H}_7\text{OH}$ .**—(*Official*.) See page 855.

**Benzonaphthol. Naphtyl Benzoate.**—Beta-naphtholum Benzoi-cum.



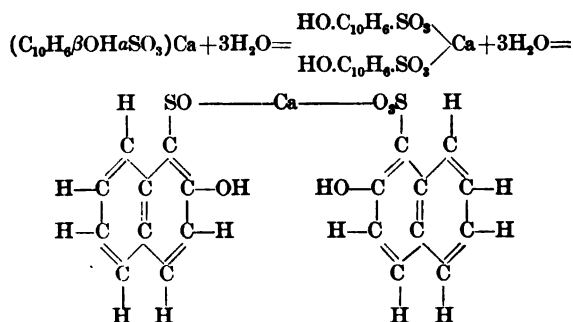
**Manufacture:** Act on beta-naphthol with benzoyl chloride; reaction begins at 125° C. (257° F.) and is complete in half an hour at 170° C. (408° F.), when the product is washed several times with dilute solution of sodium hydroxide and recrystallized from hot alcohol. It is in colorless needles, soluble in alcohol, chloroform, slightly in water, melts at 107° C. (225° F.). Dose, gr. 4–8 (.26–.5 Gm.) in capsule, or suspended in syrup and water; may be applied in powder.

**PROPERTIES AND USES.**—Local and intestinal antiseptic.

**Di-iodo-beta-naphthol. Naphthol-aristol, C<sub>10</sub>H<sub>6</sub>I<sub>2</sub>OH.**—This compound is prepared like aristol; greenish-yellow, slightly soluble in alcohol, ether, acetic acid, very soluble in chloroform, insoluble in water.

**PROPERTIES AND USES.**—Antiseptic; locally like iodoform.

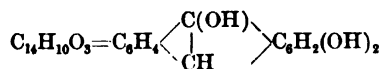
**Asaprol. Calcium beta-naphthol-alpha-mono-sulphonate.**



**Manufacture:** Neutralize the free acid beta-naphthol-alpha-mono-sulphonate with calcium carbonate, concentrate the solution and crystallize. It occurs as a white powder, soluble in water or alcohol, neutral reaction, not altered by heat, non-irritant, toxic, does not affect digestion, and is eliminated by the kidneys. Dose, gr. 5–20 (.3–1.3 Gm.).

**PROPERTIES AND USES.**—Antiseptic, antipyretic, analgesic; influenza, typhoid fever, rheumatism.

**Anthrarobin. Des-oxy-alizarin.**—Dioxy-anthrol, Leuko-alizarin.

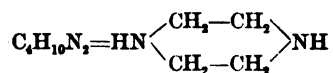


**Manufacture:** Act on alizarin with nascent hydrogen— $C_{14}H_8O_4 + H_2 = C_{14}H_{10}O_3 + H_2O$ . It occurs as a yellowish powder, soluble in caustic alkalis, glycerin, or alcohol, insoluble in water or diluted acids.

**PROPERTIES AND USES.**—In skin diseases like chrysarobinum; ointment (10–20 p. c.). See page 331.

## VII. ORGANIC BASES.

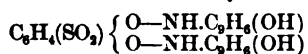
**Piperazine. Piperazina.**—Diethylene-diamine, Ethylene-imine, Arthriticine.



**Manufacture:** By the action of ammonia upon ethylene bromide or chloride, giving a mixture of salts of different bases, including diethylene diamine, which is separated by treating solution of mixed salts with excess of sodium nitrite at  $70^\circ C.$  ( $158^\circ F.$ ), yielding dinitroso-piperazine as crystalline mass, treat with acids or reducing agents, getting ammonia and salts of piperazine, distil with alkalis to obtain pure base. It is in colorless, acicular crystals, soluble in water, less so in alcohol, very hygroscopic; dissolves 12 times more uric acid than will lithium carbonate, and its urate compound is soluble in 50 parts water, lithium urate in 368. Dose, gr. 10–15 (.6–1 Gm.).

**PROPERTIES AND USES.**—Diuretic. Increases the urea, but diminishes the uric acid in urine; gout, rheumatism; large doses may produce tremors, clonic spasms, general depression.

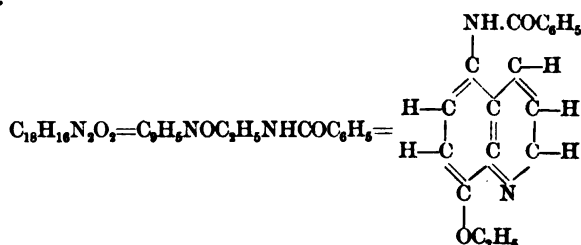
**Diaptherin. Oxy-quin-aseptol.**—Oxychinaseptol.



**Manufacture:** This is made by uniting 2 molecules of ortho-oxy-quinoline with 1 molecule of ortho-phenol-sulphonic acid. It is a bright yellow powder of hexagonal prisms, soluble in water, diluted alcohol, non-caustic and non-toxic, which properties render it preferable to phenol (carbolic acid).

**PROPERTIES AND USES.**—Antiseptic, wounds (in 1 p. c. solutions).

**Analgen. Benzanalgen.**—Ortho-ethoxy-ana-mono-benzoyl-amido-quinoline.

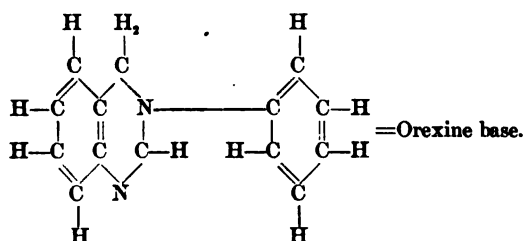
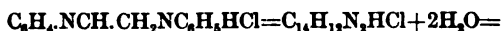


This is obtained, by a very complicated process, as a white, neutral, tasteless powder, soluble in hot alcohol or acids, slightly in cold al-

cohol, insoluble in water, melts at 208° C. (406° F.). Dose, gr. 10–15 (.6–1 Gm.).

PROPERTIES AND USES.—Antipyretic, antirheumatic; rheumatism, neuralgia, headache.

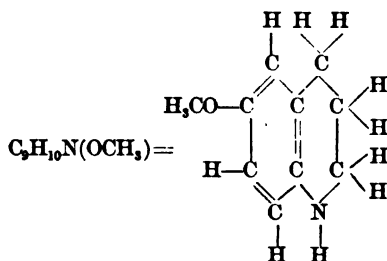
**Orexine Hydrochloride.** Phenyl-di-hydro-quinazoline Hydrochloride.



*Manufacture:* Start with formanilide, making sodium formanilide, then orthonitrobenzyl-formanilide, and finally orexine hydrochloride. It occurs as a white powder, or in acicular crystals, bitter, pungent taste, soluble in alcohol, 13 parts water, insoluble in ether, very irritating to the nostrils. The tannate causes no gastric irritation.

PROPERTIES AND USES.—Stomachic. Dose, gr. 4–8 (.26–.5 Gm.), in wafers, to be accompanied with a large draught of water.

**Thalline.** Tetra-hydro-para-quin-anisol.



*Manufacture:* Heat a mixture of para-amido-anisol, para-nitro-anisol, glycerin, sulphuric acid, then treat this with tin and hydrochloric acid. The free base at ordinary temperatures is an oily liquid, but on cooling gives yellowish-white crystals, soluble in alcohol, ether, benzene, sparingly in benzin or water, anise-like odor, nauseous, with oxidizing agents gives green color and forms salts with acids.

**Thalline Sulphate.** Thallinae Sulphas,  $2(C_{10}H_{13}NO)H_2SO_4$ , or  $2C_9H_{10}N(OCH_3)H_2SO_4 + 2H_2O$ .—This is obtained by dissolving thalline in diluted sulphuric acid and crystallizing or granulating. This salt is that which is used mostly, often being designated simply as thalline. It occurs as a yellowish-white crystalline powder, anise-like odor, nauseous, bitter, saline, pungent taste, soluble in hot water, spar-



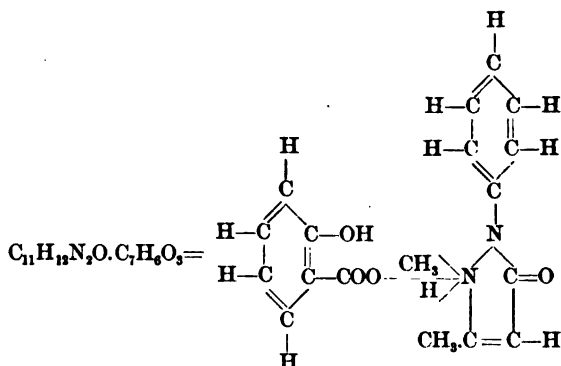
ingly in chloroform or ether, 7 parts of cold water, 100 alcohol; solutions darken with age and exposure to light; contains thalline 76.9 p. c. and sulphuric acid 23.1 p. c.

**Thalline Tartrate.** *Thallinæ Tartras*,  $C_{10}H_{13}NO_4 \cdot C_4H_6O_6$ .—This is a yellowish-white crystalline powder, resembling the sulphate in appearance and taste, but is much less soluble in water, requiring 10 parts; contains thalline 52.2 p. c. and tartaric acid 47.8 p. c.

**PROPERTIES AND USES.**—These thalline compounds are antipyretics, germicides, rarely used internally, being poisonous; useful as injections for gonorrhœa in 1–2 p. c. solutions.

**Antipyrine.** *Antipyrina*,  $C_6H_5(CH_3)_2C_3HN_2O$  or  $C_{11}H_{12}N_2O$ .—(*Official.*) See page 859.

**Antipyrine Salicylate.** *Salipyrine*.



**Manufacture:** By the direct union of molecular proportions of antipyrine and salicylic acid, which is accomplished by heating together 57.7 p. c. of the former and 42.3 p. c. of the latter, dissolving in alcohol and crystallizing. It is a white crystalline powder, sweetish taste of salicylic acid, soluble in alcohol, chloroform, ether, 25 parts boiling water, 200 water, melts at  $91^\circ C.$  ( $196.7^\circ F.$ ). Dose, gr. 2–20 (.13–1.3 Gm.).

**PROPERTIES AND USES.**—Antirheumatic, antineuralgic; chronic articular rheumatism, sciatica.

**Hypnal.** *Monochloral Antipyrine*,  $CCl_3CH(OH)_2 + C_{11}H_{12}N_2O$ .

**Manufacture:** About equal quantities or the molecular proportions of antipyrine and hydrated chloral are each separately dissolved in water, then mixed together, and the underlying oily stratum allowed to crystallize. It is in colorless crystals, nearly tasteless, non-irritating to mucous membranes, soluble in 15 parts water, melts at  $67.5^\circ C.$  ( $154^\circ F.$ ). Dose, gr. 2–20 (.13–1.3 Gm.).

**PROPERTIES AND USES.**—Hypnotic; analgesic.

**Iodopyrine.** Iodantipyrine,  $C_{11}H_{11}IN_2O$ .

*Manufacture:* A hot solution of 1 part iodine in 12 parts alcohol is mixed with a solution of 1 part antipyrine in 4 parts alcohol. The mixture after several days will deposit crystals of iodopyrine. This is a substitute for antipyrine in which 1 hydrogen atom in the benzene nucleus is replaced by iodine. It is in colorless, silky, prismatic, tasteless needles, odorless, soluble in hot water, alcohol, slightly in cold water, melts at  $160^{\circ}C$ . ( $320^{\circ}F$ ). Dose, gr. 2–20 (.13–1.3 Gm.).

**PROPERTIES AND USES.**—Causes fall of temperature, with perspiration, without collapse or shivering. Has no advantage over antipyrine.

**Iodol.** Iodolum,  $C_4I_4NH$ .—(*Official.*) See page 860.

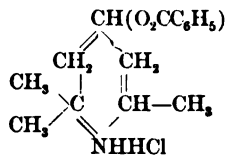
**Cocaine.** Cocaina. Methyl-benzoyl-ecgonine,  $C_{17}H_{21}NO_4$ , and Cocaine Hydrochloride. Cocainæ Hydrochloridum,  $C_{17}H_{21}NO_4 \cdot HCl$ .—(*Official.*) See pages 343, 344.

**Eucaïne.** Eucaïna.—The eucaïnes are synthetic alkaloidal derivatives of triacetaminine and vinyl-diaceton-alkalamine, the former yielding commercial alpha-eucaïne hydrochloride, the latter, beta-eucaïne hydrochloride, both used as substitutes for cocaine, having the advantage of being less toxic, and aqueous solutions not decomposing on boiling.

1. **Eucaïne Hydrochloride ( $\alpha$ ).** Eucaïnæ Hydrochloridum ( $\alpha$ ).—Alpha-eucaïnium (eucaïne), Hydrochloride of benzoyl-n-methyltetramethyl-y-oxy-piperidine-carboxylic methylester,  $C_{19}H_{27}NO_4 \cdot HCl + H_2O$ .

*Manufacture:* Treat triacetaminine with hydrocyanic acid, hydrolyze product by boiling with water, introduce benzoyl and methyl groups by successive treatment with benzoyl chloride and methyl iodide, and the resultant product is the free base—alpha-eucaïne (eucaïne- $\alpha$ ), which can be crystallized from ether or alcohol. It is in large, glossy colorless prisms, soluble in ether, alcohol, chloroform, benzene, slightly in water, forms salts with acids, the hydrochloride being in glossy neutral scales or plates, soluble in 10 parts water. Differs from cocaine hydrochloride in being less soluble in water, giving yellow crystalline precipitate with 5 p. c. solution chromic acid.

2. **Eucaïne Hydrochloride ( $\beta$ ).** Eucaïnæ Hydrochloridum ( $\beta$ ).—Beta-eucaïnium (eucaïne), Benzoyl-vinyldiacetonalkamine hydrochloride,  $C_{15}H_{21}NO_2 \cdot HCl$ .



**Manufacture:** Treat diacetoneamine with paraldehyde, reduce product with metallic sodium to vinylacetonealkamine, and benzoylate the latter by treating with benzoyl chloride; the resulting free base is dissolved and neutralized with hydrochloric acid, and crystallized. It is a white neutral crystalline powder, soluble in 20 parts water; 5 p. c. solution yields no precipitate with mercuric chloride (dis. from *alpha*-eucaine); chromic acid gives yellow precipitate soluble in hot water.

**PROPERTIES AND USES.**—Both are local anæsthetics; closely related to cocaine and tropacocaine. The *alpha*- was introduced first, but, owing to its ocular irritation and frequent toxic effects similar to cocaine, it has largely given away to the *beta*-eucaine. This latter salt has the advantage over cocaine in that it affects heart circulation and respiration much less, does not dry the corneal epithelium, nor cause mydriasis or disturbed accommodation; solutions may be sterilized by boiling without decomposition, and are stable (dif. from cocaine); it has, however, the disadvantage of causing hyperæmia rather than contraction of mucous membranes when applied locally; largely employed in ophthalmology, in 2–5 p. c. solutions; for mucous surfaces 2–5 p. c. Dose, hypodermically Mxv–60 (1–4 Cc.) of 5 p. c. solution; may employ ointment 1 p. c. (+ olive oil 2, wool-fat 7).

**Poisoning.**—Less poisonous than cocaine, but when taken internally produces similar effects; excessive quantities should be combated by strong coffee, alcohol, digitalis, strychnine, ammonia, ether, nitroglycerin.

**Theobromine. Di-methyl Xanthine,  $C_5H_2(CH_3)_2N_4O_2$ .**

**Manufacture:** From the seeds of *Theobroma Cacao* and from xanthine, which is a substance closely related to uric acid. It is in colorless bitter crystals, sparingly soluble in water, alcohol, or ether. See page 417.

**Caffeine. Caffeina (Theine).**—Tri-methyl Xanthine,  $C_5H(CH_3)_3N_4O_2 + H_2O$ . (*Official.*) See page 565.

**Theobromina Sodio-salicylas. Theobromine Sodio-salicylate. Diuretin.**—Theobrominum Natrio-salicylicum,  $C_7H_7N_4O_2Na + C_6H_4(OH)COONa$ . See page 417.

**Manufacture:** Mix aqueous solutions of equal quantities (molecular proportions) of sodium theobromine and sodium salicylate and evaporate to dryness. It contains theobromine 49.7 p. c., salicylic acid 38.1 p. c., and corresponds to the most popular caffeine salt used in Germany=Caffeine Sodio-salicylate. It is a white, odorless, amorphous powder, salty, alkaline taste, soluble in half-weight of warm water, which remains clear upon cooling. Dose, gr. 15–30 (1–2 Gm.).

**PROPERTIES AND USES.**—Diuretic. Has no heart action, nor does it irritate the kidneys. Good in cardiac or hepatic dropsy.

## PART VI.

### THE MICROSCOPE AND ITS USE IN MATERIA MEDICA.

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ALTHOUGH it is impossible for all druggists to become experienced with the microscope, yet every one, by a little patience, study, and tact in its use, may learn sufficient to have it serve him often to advantage. One readily admits the importance of such knowledge when he observes that the skilful manipulator, in many cases, shares equal honors with the chemist in determining qualitative (sometimes quantitative) analyses of various substances—in fact, a number of plant-constituents, as starches, oils, acids, sugars, crystals, alkaloids, etc., yield in the hands of chemists and microscopists similar and equally satisfactory results. While it is not the intention here to go very deeply into the subject, it is, however, desired to give that which the average pharmacist, if so disposed, can put with profit into practice. Special laboratory course or various treatises pertinent to this department should be availed of for more extended information.

#### I. DESCRIPTION OF THE MICROSCOPE.

Of these there are two kinds—simple and compound.

*The Simple Microscope* is only a hand magnifying-glass or linen-tester, and consists of a double convex lens (or several mounted in juxtaposi-

FIG. 464.



Simple microscope (watchmaker's).

FIG. 465.



Simple microscope (magnifier).

tion on a common axis), giving an extensive field of view and an erect

image 5–30 times the size of the object. This instrument is valuable in field botanic work, crystallography, deciphering illegible prescriptions, recognizing various fabrics and other objects indistinctly visible by the naked eye.

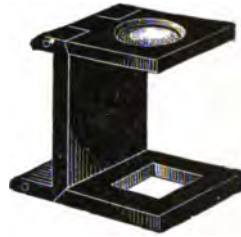
*The Compound Microscope* is a more complex instrument, and consists of several lenses so separated at focal distances that each one

FIG. 466.



Simple microscope. (CODDINGTON.)

FIG. 467.



Simple microscope (linen-tester).

serves to magnify the image transmitted by the preceding one. The higher the magnifying powers used, the smaller becomes the area of the object that is seen through the instrument, and the light being correspondingly diffused over a larger area in the image, the latter

FIG. 469.



Folding dissecting microscope.

FIG. 468.



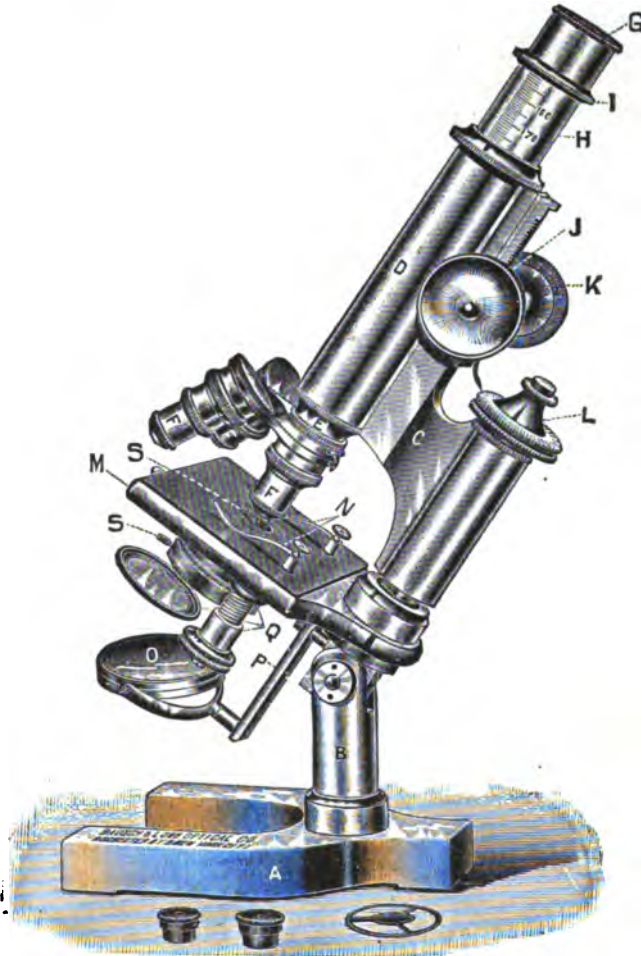
Tripod dissecting microscope.

appears less bright. The image is always inverted and magnified 10–4,000 times.

1. *The Ocular or Eye-piece* (G).—This, in the line of vision, is the part nearest to the eye, and has several types—Huyghenian, Conti-

mental, Kellner, Binocular, Solid (all negative), Ramsden, etc. (positive). The first named is used mostly, and consists of two plano-convex lenses (plane surfaces upward) mounted in a short metal tube: the one next to the eye—eye-lens; the one farthest—field-lens. Between these two a diaphragm is so placed as to cut off the blurred

FIG. 470.



Compound microscope. A, base; B, pillar; C, pillar and arm; D, body; E, nose-piece; F, objective; G, ocular; H, draw-tube; I, collar; J, rack and pinion; K, coarse adjustment; L, fine adjustment; M, spring clips; N, stage; O, mirror; P, mirror bar; Q, diaphragm and substage; R, substage screw; S, stage aperture; T, pillar hinge-joint.

edges of the image, thus giving a flat field and a sharp, round outline to the field of vision. The ocular magnifies the real image produced by the objective as though that image were itself the original object; its magnifying power is inversely proportional to the length—the longer the tube, the lower the power. Oculars are designated as

follows : A—2 inch, B—1½ inch, C—1 inch, D—¾ inch, E—½ inch—the first weakest, the last strongest.

2. *The Objective (F).*—This, in the line of vision, is removed farthest from the eye and is the most essential portion of the instrument ; to its many improvements (also further susceptibilities) are

FIG. 471.



Ocular (Huyghenian).

FIG. 472.



Ocular (Continental).

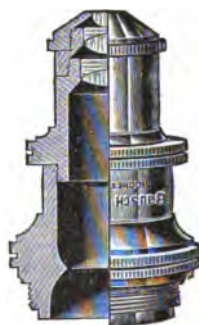
(and will be) due the great advancements in vegetable and animal histology. It consists usually of a front plano-convex lens (convexity upward), together with one, two, or three others, which may vary in shape between plano-convex, concavo-convex, and bi-convex (according to manufacture), working in combination as a single magnifier, thus

FIG. 473.



Objective, 3-inch.

FIG. 474.



Objective, 4-inch.

FIG. 475.



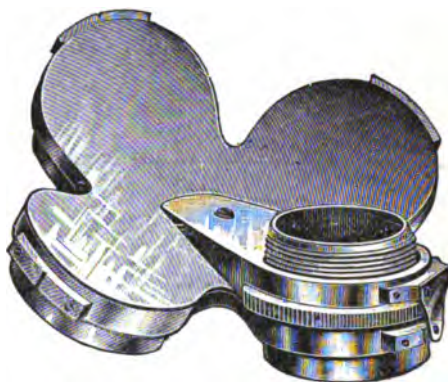
Oil-immersion objective, ¼-inch.

producing an enlarged inverted and reversed image—this simple image being that which the ocular receives, and in turn magnifies. Objectives may be either *dry* or *immersion*, according as they are used without or with a drop of liquid between the lens and the object ; if the liquid used has same refractive power as the glass lens, then it is



called *homogeneous immersion*. Objectives are known by whole numbers and fractions, thus:  $4-3-2-1\frac{1}{2}-1-\frac{3}{4}$ -inch = lower power;  $\frac{1}{4}-\frac{1}{5}$ -inch = medium power;  $\frac{1}{6}-\frac{1}{8}-\frac{1}{10}-\frac{1}{12}-\frac{1}{16}-\frac{1}{20}-\frac{1}{25}$ -inch = high power, all of which are but expressions for intrinsic focal distance; a 1-inch objective, hence, has the same magnifying power as a simple lens with 1-inch focus, etc. The strength is inversely as these figures—smaller the fraction the greater the magnifying power, also smaller the end lens the greater the power; whereas working-distance, field of view, and amount of light are all directly as these figures—becoming less as the fraction diminishes. Objectives of low power, 2-1-inch, serve best for pharmacists, as these afford good working distance, hence the inspection of most objects without risk of injuring the lower lens.

FIG. 476.



Objective nose-piece.

The following table shows approximate magnifying powers of oculars and objectives taken conjointly under the indicated combinations :

Oculars.	Objectives.												
	3 in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	⅓ in.	¼ in.	⅓ in.	⅓ in.	⅓ in.	⅓ in.	⅓ in.
A—2 inch.	11	16	23	30	55	88	190	230	265	345	382	580	820
B—1½ "	16	22	33	41	74	120	260	315	340	460	525	810	1100
C—1 "	21	30	44	53	96	155	355	410	450	590	701	1060	1420
D—¾ "	28	40	56	69	130	200	455	550	585	770	900	1400	1860
E—½ "	35	54	70	85	165	265	560	710	750	980	1110	1760	2350

This compilation is based upon tube length being 160 Mm.— $6\frac{3}{10}$  inches; for instruments whose tube length is 216 Mm.— $8\frac{1}{2}$  inches—an increase of about 25 p. c. must be added in each case.

Several higher objectives are made— $\frac{1}{10}-\frac{1}{50}-\frac{1}{80}$ -inch, which magnify 2,000–5,000 diameters according to ocular used. These all contain, in addition to the 2–4 lenses for magnifying, a combination of lenses for correcting chromatic and spherical aberrations, the most of which, however, is compensated for by the opposite aberration of the ocular.

*Chromatic Aberration.*—The lens proper is not only a magnifier, but also a prism; owing to this latter fact a ray of light in passing through it is deflected from its course and resolved into its elementary colors, thus giving, unless rectified, colored marginal bands around the image of the objects examined. This chromatic defect is overcome satisfactorily by a combination of lenses having opposite aberrations, namely, a con-



vex crown lens and a concave flint lens, acting together as a single convex lens.

*Spherical Aberration.*—The convex lens, being in the nature of a prism, refracts rays of light toward the axis of the lens, but as the angle of the lens is greatest at the edge and gradually diminishes toward the centre, where the faces are parallel, the rays of light going through the edge of the lens are refracted more and come to a focus nearer the centre of the lens; hence there is a want of focus of the rays, or spherical aberration. This defect interferes with the defining power—i. e., the definition of the image—the image of a flat object

becoming curved and blurred around its edges, so that in examining netted fabrics the central fibres are straight and distinct, the outer curved and indistinct. This spherical defect may be corrected by a diaphragm which cuts off border light by contracting the central aperture.

3. *The Body (D).*—This consists of the two long telescoping tubes: the outer—the sleeve; the inner—the draw-tube. To the upper end of the body (draw-tube) is attached the ocular, to the lower end the objective.

4. *The Stand (A, B, C, etc.).*—This is all the remaining portion of the instrument, and its



Screw substage.

various parts have received distinctive names, thus: A, base or foot—variously shaped (triangular, horseshoe, or circular), and sufficiently heavy to insure steadiness; B, pillar—portion above and below the stage, often jointed; C, arm; E, nose-piece—double, triple, or quadruple, into which several objectives are screwed, so that by turning either may be brought into visual position; F, objective; G, ocular; H, draw-tube; I, collar; J, rack and pinion; K, coarse adjustment; L, fine adjustment, both worked by a milled screw; M, stage; N, spring clips; O, mirror—with concave and plane surfaces, the former being used mostly; Q, diaphragm and substage; R, substage screw; S, stage aperture and substage; V, Abbé condenser—gives more light to objective, being of special service when examining stained specimens, which are recognized chiefly by color and not by outline.

## II. REQUISITES OF A GOOD MICROSCOPE.

Almost any make of high-grade instrument will give satisfaction that has the following qualities:

1. It should possess firmness and solidity through its base, pillar, arm, etc.

2. It should have a good-sized stage, preferably square, thick, firm, of glass, metal, or vulcanite.

3. It should have coarse and fine adjustments, worked by rack and pinion; both should move evenly, smoothly, promptly, without wobbling.

4. It should possess working distance; thus the higher objective when in focus should leave sufficient space above the stage for the introduction of slides, etc., without danger of contact. The longer the working distance, the less will the distinctness of the image formed be affected by any given alteration in its focal adjustment. Lenses with greatest working distance have most focal depth.

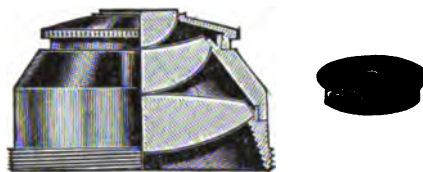
5. A nose-piece is essential in order to economize time and facilitate work. This may be either double, triple, or quadruple, and is an appliance fitting the tube's extremity for carrying 2, 3, or 4 objectives, of varying power, any one of which may quickly be brought into direct position by turning the arm on a pivot.

6. The penetrating power (focal depth or range of focus) should be considerable. This quality, though not necessary for very thin sections, enables one to see the parts of an object not exactly in focus with sufficient distinctness to allow their relations with what lies exactly in that plane to be clearly traced out. Thus one lens may only for an instant give a sharp focus at a limited distance from the object, while another lens may give a good image at a considerable distance above and below the best focal point; the first kind of lens prevents us from ascertaining the relation of the higher layers of an object to the lower unless we continually follow the focus with the fine adjustment; the second kind of lens, having greater penetration, brings a thicker portion of the object into view at the same time—the greater the penetrating power, the better the microscope.

7. Flatness of the field varies with the magnifying power and angle of aperture of the lens. Here all parts of the field are in focus at the same time, so that the image is distinct over the whole field at once without marginal color. This requisite should be tested for under an eye-piece giving a large aperture.

8. The distinctness of the image (defining power) should be good;

FIG. 478.



Abbé condenser.

FIG. 479.



Iris diaphragm.

this depends upon the complete correction of chromatic and spherical aberrations, and upon the accurate centering of the lenses, otherwise the outer borders will be blurred.

9. Resolving power, by which very minute and closely approximated markings, lines, striæ, dots, and apertures can be discerned separately; the maximum capacity thus far attained being the separation of 118,000 lines per linear inch. These three last qualities are very essential.

### III. DIRECTIONS FOR USING THE MICROSCOPE.

1. For working, select a northern window; this insures the greatest amount of reflected light possible from white clouds. Never use direct sunlight, and if possible avoid artificial light. If southern exposure alone is available, have window-blind, and that well drawn.

2. The instrument should be placed between the operator and the window, and, all working parts being in order, the mirror and lens to be used should be wiped with soft chamois leather.

3. The body of the microscope should be about vertical, so as not to interfere with mounting in fluid media; the mirror should be adjusted to reflect light through the instrument, using plane side for parallel rays and concave side for divergent rays.

4. Having inserted objectives into the nose-piece, place object for examination in the centre of the slide under the cover-glass, and this as near the middle of the stage as possible; adjust light by mirror and diaphragm, and focus with coarse adjustment.

5. Make all first examinations with low power and large diaphragm aperture, at least the one yielding distinct vision; then follow with higher powers and smaller apertures. The power should always be increased at the objective first, observing the following combination:

Ocular.	Objective.
2 inch . . . . .	$\frac{3}{8}$ inch = low power.
2 " . . . . .	$\frac{1}{2}$ " = medium power.
$1\frac{1}{2}$ " . . . . .	$\frac{1}{8}$ " = high power.

6. Hold and adjust slides with thumb and forefinger of left hand; manipulate coarse and fine adjustments with right hand.

7. To focus, turn the objective down toward slide by means of coarse adjustment, short of contact; then with eye over the ocular focus backward until object is in view; from this point the exact focus can be made by one turn of the fine adjustment. With high powers focus in the same way, never allowing lower end lens of objective to come in contact with cover-glass or any liquid, as such carelessness usually results in injury to object and objective. When properly focused, work fine adjustment slightly forward and backward during observations, to get a series of optical sections of the object; also move slide on stage to bring in view different parts.

8. Never lift slides from stage, but gently slide them off without upward movement. Previous to doing this the tube should be raised out of focus, especially with high powers.

9. Accustom yourself to use both eyes indifferently, and when one is in use keep the other open—never closed; this can soon be acquired with a little practice.

10. In examining powdered specimens, a very small amount is placed upon a slide centrally, a drop of water or glycerin added with a pipette; now put over this with forceps (slantingly to avoid air-bubbles) a cover-glass, using slight pressure on it after it is in proper position, and absorb superfluous fluid with camel's-hair pencil or blotting-paper.

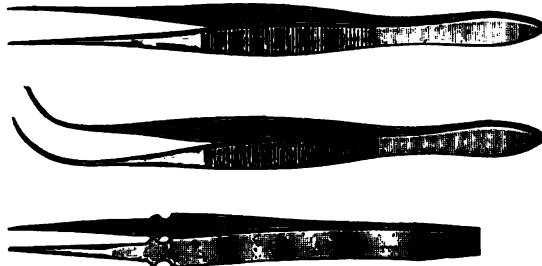
11. If specimen be tissues of which cross-sections are to be taken, use for this purpose a razor or microtome (the latter only in experienced hands). The razor should have lower surface flat, upper slightly hollow-ground; should be sharp, opened in straight line with handle, and sections made by pulling from heel to toe, using in the sliding cut considerable edge length. Both razor and object should be wet while cutting, to prevent adhesion and admission of air; if material is fresh, use for it water or diluted alcohol; if material has been hardened, employ same strength alcohol as used in the hardening process.

12. Hold objects between the forefinger and thumb, allowing the razor to rest upon the former, when the sliding cut can be made. Sections should be cut as thin as possible so as to include but one layer of cells, which proficiency can be acquired only after considerable practice. Remove sections with a camel's-hair pencil to a watch-glass containing water, and as desired arrange a section on the slide under the cover-glass with a drop of water, when it is ready for examination and the introduction of various reagents. If object be too small for such handling, it should be imbedded in some relatively hard substance—dried elder pith, cork, paraffin, etc., and then cross-sections taken as before, but through the combined mass.

#### IV. ACCESSORY APPARATUS AND REAGENTS.

1. A pair of fine-pointed forceps for handling cover- and watch-glasses, small objects, etc.

FIG. 480.



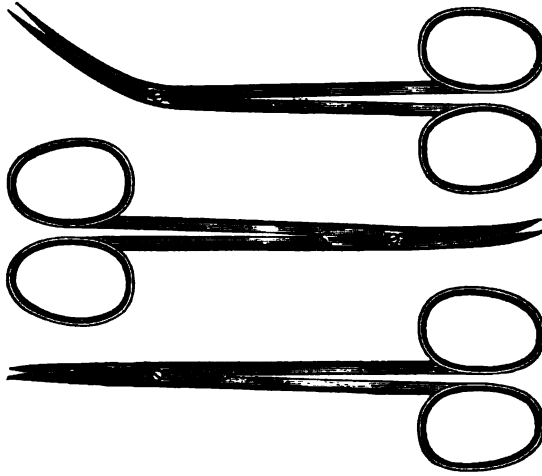
Dissecting-forceps.

2. A pair of fine scissors, sharp-pointed and bent, for dividing tissues, etc.

3. A pair of dissecting-needles for teasing tissues apart, etc.

4. A good razor, under side flat, upper slightly concave, edge straight, also strop and hone.
5. A supply of glass slides 3 x 1 inch, with ground edges, also cover-glasses, square or circular,  $\frac{1}{4}$ – $\frac{7}{8}$  inch, section-lifters, etc.
6. Watch-glasses (flat bottom) in which sections are to be bleached, stained, etc.

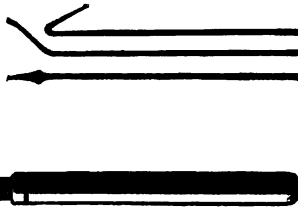
FIG. 481.



Dissecting-scissors.

7. Graduated ruler for drawing and estimating magnifying power.
8. Camera lucida for drawing, the Abbé being the best.
9. Spirit lamp, racks for holding slides and reagent bottles.
10. Pipettes, glass rods, camel's-hair pencils, blotting-paper, cha-mois.
11. Micrometer adapted either to the eye-piece or stage, or to both.
12. Turn-table with self-centering device, for mounting and finishing slides.

FIG. 482.



Dissecting-needles.

13. Caustic potash—2–5–10 p. c. solutions, used to dissolve proteids, starch, to swell cell-walls, etc.
14. Acetic acid (glacial), 1–2 p. c. solutions, for defining nucleus, clearing cell-contents, in staining, and to distinguish calcium oxalate from calcium carbonate—the latter dissolving with effervescence.

15. Sulphuric acid, 92 p. c.—dissolves starch and cellulose, converting them into dextrin and amyloid, respectively; diluted acid (10 p. c.)—serves to identify crystals in cells. Thus calcium oxalate, carbonate, phosphate, and malate, all are converted into needles of calcium sulphate, while sphere crystals of inulin, resembling calcium phosphate, are dissolved completely.

16. Hydrochloric acid—as a clearing agent, with phenol, thymol, aniline chloride, etc.; also to distinguish calcium oxalate from carbonate (dissolves latter with effervescence, the former slowly without

FIG. 483.



Camera lucida (brass mounted).

FIG. 484.



Ocular micrometer.

effervescence); also to modify overstained sections from hæmatoxylin, carmine, and aniline solutions.

17. Nitric acid, 68 p. c.—causes protoplasm to shrink from cell-wall, and when ammonia is added afterward we have the middle lamella stained yellow; a 30 p. c. solution swells and finally dissolves amyloid.

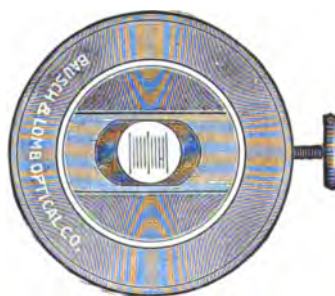
18. Chromic acid (strong solution)—separates cells of thick-walled tissue, dissolving easily the middle lamella, finally the entire cell; a  $\frac{1}{2}$ –1 p. c. solution fixes cell-contents of tissues by soaking in it 24 hours, then wash and stain.

19. Compound iodine solution (tincture iodine + potassium iodide) stains starch blue, proteids yellowish-brown, lignified cell-walls deep brown, kills protoplasm without dissolving it, is a fixing agent, and with  $H_2SO_4$  becomes a test for cellulose.

20. Chlor-zinc-iodine (Schulze's solution)—colors cellulose blue, lignified and cutinized tissues brown, starch is turned blue, swells and dissolves; swells cells-walls and stains protoplasmic threads brown, therefore is used in studying continuity of protoplasm from cell to cell.

21. Aniline chloride, colorless, 5 p. c. alcoholic solution, or saturated aqueous solution + sufficient HCl to acidify—stains lignified tissues deep yellow, but does not affect cellulose and cutinized tissues.

FIG. 485.



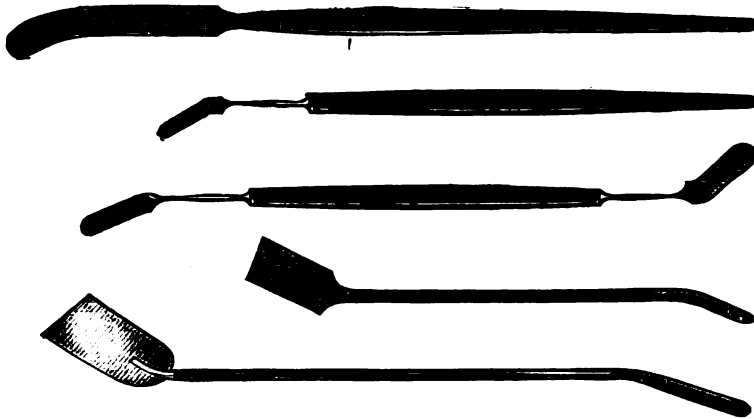
Sectional view of ocular micrometer.

22. Fehling's solution—with grape-sugar a red color is obtained. If cane-sugar be present, a bluish or greenish color appears.

23. Ammonio-ferric alum—with tissues containing tannin gives bluish-black or greenish-black precipitate.

24. Silver nitrate, 2–3 p. c. solution—develops the laminæ in starch-grains and in thick-walled cells.

FIG. 486



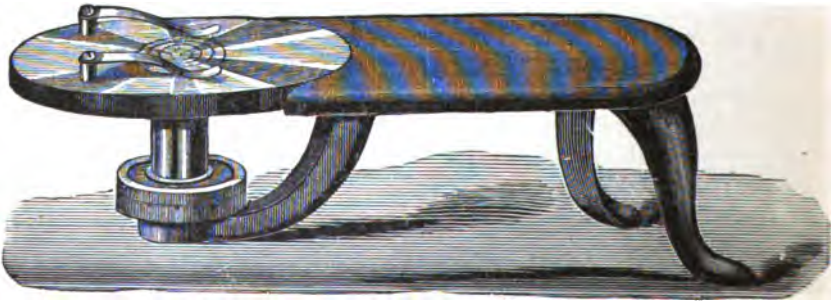
Section-lifters.

25. Diphenylamine solution—turns tissues blue that contain nitrates.

26. Sulphuric ether—dissolves out oils, resins, fats, etc.

27. Alcohol—preserves tissue, dissolves chlorophyll, coloring-agents, resins, oils ; also bleaches.

FIG. 487.



Turn-table.

28. Phenol (carbolic acid)—useful clearing agent, can mount directly from this solution.

29. Glycerin—for clearing sections, preserving tissues for temporary or permanent mounting.

30. Canada balsam—for permanent mounting.

## V. SOME ADVANCED MICROSCOPIC METHODS AND APPLIANCES.

1. *Estimation of Magnifying Power.*—While the table given on page 899 is of interest and service, yet, owing to slight variations therefrom in almost every microscope, each operator always prefers to test his own by one or all of the following methods:

(a) By taking absolute measurements. Ten inches are recognized generally as the normal length of distinct vision with the naked eye. Now, suppose the distance from an object in focus to the upper end of ocular is 10 inches, and that the 2-inch ocular and 1-inch objective are in service, we will then have the ocular focusing at 2 inches what the eye does in 10, or it magnifies 5 diameters— $10 \div 2 = 5$ ; also the objective focusing at 1 inch what the eye does in 10, or it magnifies 10 diameters— $10 \div 1 = 10$ ; consequently these two combined— $5 \times 10 = 50$ , which is the total magnification of the instrument as arranged. If we use 1-inch ocular and  $\frac{1}{2}$  objective, we have  $10 \div 1 = 10 =$  magnification of ocular alone;  $10 \div \frac{1}{2} = 50 =$  magnification of objective alone; hence the two combined— $10 \times 50 = 500$  diameters = combined magnification.

(b) By a stage micrometer and a 2-inch boxwood rule. This micrometer is but a glass slide having 1,000 ruled lines to the inch. When this is focused and the rule placed in front of and parallel with it on the stage, we can compare the two simultaneously by looking at the micrometer through the microscope with one eye and at the ruler with the naked eye. If the micrometer spaces now appear  $\frac{1}{2}$  inch apart, the magnifying power is 500 diameters; if 1 inch apart, then 1,000 diameters.

(c) By stage micrometer and camera lucida. This gives greater accuracy, and is accomplished by focusing stage micrometer and placing a camera lucida on the eye-piece. To one side in same plane as stage place a sheet of white paper at right angles to the object viewed, and upon this will be projected the image of the lines, which then can easily be drawn and the distance between any two measured. Suppose they are  $\frac{1}{2}$  inch apart; now those on micrometer are  $\frac{1}{1000}$  inch apart, hence magnifying power is 200 diameters— $\frac{1}{2} \div \frac{1}{1000} = \frac{1000}{2} = 500$ . Instead of the camera lucida, an eye-piece micrometer in conjunction with the stage micrometer can also be used with equal if not better results.

2. *Hardening.*—If tissues to be examined are not sufficiently firm to allow satisfactory cutting—as tender parenchyma of non-vascular plants, they should be hardened by soaking several hours in diluted alcohol, then in pure alcohol. The employment of several alcohols varying in strength prevents tissue-contraction by osmotic action. Alcohol here dissolves resins, volatile oils, chlorophyll, thus acting as a bleaching agent. It coagulates and kills protoplasm without impairing its structure, also renders it more opaque, when it may readily be stained with the various fluids; it also dehydrates tissues previous to being mounted in Canada balsam.



3. *Softening*.—All dry and hard substances should be softened before sections can be made properly. In the case of roots, rhizomes, tubers, corms, fruits, seeds, etc., they are soaked first in alcohol half an hour to expel air, then in water several hours or until saturated (hard tissues, shells, etc., may require several days); if now too soft for cutting, lay in alcohol 24 hours; if again too hard or brittle, place in a mixture of equal parts of alcohol and glycerin for 24 hours. In such roots as gentian, etc., that are much shrunk, we should use for water in second stage a 1–2 p. c. aqueous solution of potassium hydroxide or ammonia; this alkali, however, should always be washed out with water before hardening. Specimens thus prepared can be kept always in readiness by letting them remain immersed in a mixture of equal quantities of alcohol and glycerin.

4. *Clearing*.—It is often necessary to clarify sections by having absorbed from them such substances as would prevent transparency—starch, resins, oils, etc. To accomplish this, sections should be boiled in water and put into diluted Labarraque's solution for 15 minutes, or placed for a short while into a mixture of 4 parts oil of turpentine + 1 of creosote, or into pure oil of cloves, then mounted in Canada balsam. When sections have been stained, should soak them first in alcohol for a few minutes and then in the clearing-mixture.

5. *Staining Fluids*.—These make prominent and differentiate thin cell-walls, inconspicuous and uniform tissues, etc., thus making their differences in appearance very perceptible.

(a) *Hæmatoxylin*. Prepared by mixing 2 parts saturated alcoholic solution hæmatoxylin with 75 parts saturated aqueous solution ammonia alum; let stand a week in sunlight, filter, and to every 7 parts add 1 part each of glycerin and methyl alcohol, allow sediment to deposit by standing, filter. Used to stain lignified and cellulose walls—not cutinized ones; is also a good nuclear stain. Sections should soak several hours—those from alcohol should first be washed and all acids avoided.

(b) *Fuchsin*. A solution of fuchsin in water, used to stain lignified cell-walls, as these hold color better than non-lignified ones. When sections with fuchsin staining are washed with a mixture of saturated solution of picric acid 1 part + water 2 parts, the fuchsin is removed from unlignified cell-walls, while lignified ones remain beautifully stained. These may now be dehydrated and mounted, or double-stained with aniline blue, then dehydrated and mounted.

(c) *Methyl-green*. An aqueous solution of methyl-green sufficiently strong to give deep green color. It stains protoplasm, nucleus, also lignified and cutinized tissues better than it does cellulose. Tissues absorb color quicker if previously washed in weak acidified ( $\text{HNO}_3$ ) water.

(d) *Iodine-green*. Made by dissolving iodine-green in water until a deep green solution results. This stains lignified and cutinized tissues green, also proteids, amyloplasts attached to young starch-grains; acts on cellulose tissues slightly. Often used with carmine, eosin, or fuchsin for double staining.

6. *Mounting*.—When for only temporary or immediate use, water or glycerin, or a mixture of the two, is employed. If it is to be permanent, then Canada balsam is the best medium. Mounting is accomplished thus: The sections, if stained in aqueous solution, should first be dehydrated by placing for a few minutes in 70 p. c. alcohol, then in 90 p. c., and finally in 98 p. c.; now put for a short while in clearing medium—oil of cloves or oil of turpentine—place a section on centre of slide, add to it a drop of balsam, apply cover-glass slantingly to avoid air-bubbles, slightly tapping same to a fixed position. If just sufficient balsam is used, we have simply to let it dry several days, then ring with a circle of colored cement around marginal contact of cover-glass with slide.

## VI. THE MICROSCOPE IN THE DRUG-STORE.

While it is true that many official drugs come to us with adulterations and sophistications, yet in order to identify such with the microscope one should be perfectly familiar with the appearance of the pure drug. In order to be certain of reliable results, he should examine at least a dozen samples taken from various portions of the substance in question. In examining cross-sections of drugs in their original entire form we should know the arrangement as well as character of all the composing tissues, by which alone identification and recognition can be assured. In examining powders we have the most difficulty, as quite all the original characteristics are much changed or destroyed by comminution. Here, however, a sample of the crude article as powdered by one's self is to be compared with the specimen under consideration. Should the direct observance of a powder through the various objectives give little satisfaction, then micro-chemical reagents can, in regular sequence, be added with, as a rule, good results. By an examination with the microscope alone we can recognize readily the border-pits, so characteristic of gymnospermous plants (savin, etc.), when mixed with angiospermous powders. Again, a powder may contain, as a natural constituent, the very thing with which it is adulterated mostly (starch in black pepper, etc.); in all such cases the abnormal quantity present will show conclusively the fraudulent addition; again, resins, oil-globules, crystals, starch, etc., may be observed as present, and yet not a true constituent; such should excite suspicion and lead to application of further specific tests; again, the kind of delicate hairs as characteristic of certain plants can often be recognized whole or in part—unicellular or multicellular; the thickness and appearance of varying cell-walls; the individual variety of tissue, etc., often will aid also in the identification. The elementary components and contents of plant-tissues to be looked for are fragments of ducts, bast-cells, characteristic epidermal and stone-cells, cork, plant-hairs, glands, calcium oxalate crystals, starch, etc. The articles employed for adulterating, such as are known likely to occur in respective drugs should be studied separately, so that when encountered where not belonging they can easily

be identified. Such adulterants may consist of mineral matter, as calcium sulphate, calcium carbonate, iron carbonate, iron oxide, clay, brick, sand, sawdust, starch, flour, rosin, wood, bark, seeds, beans, peas, leather, cocoanut shells, exhausted and injured drugs, etc.

The following samples are but a few of the very many which any druggist may experiment with to his satisfaction and advantage.

**I. Roots.** 1. *Senega from False Senega*.—Soak suspected root in water until soft (10 hours), make thin cross-sections: true senega root has irregular, porous, yellowish wood; false senega root has cylindrical, porous, whitish wood. The irregularity of the structure of the cortex of senega (true) is well brought out by staining with hæmatoxylin solution. See pages 376, 378.

2. *Taraxacum from Chicory*.—Make thin cross-sections as before: taraxacum shows in the bark laticiferous ducts in many brown circles; chicory has these vessels arranged radially. The location of the laticiferous ducts is revealed readily by staining with hæmatoxylin, as they assume a darker color than the other cells on account of the dense coagulated contents of the duct. Both have deposits of inulin (which is related closely to starch) in the soft cells, which stains yellow with iodine. See pages 609, 611.

3. *Calumba from Bryonia*.—Calumba shows thick bark, small wood-bundles bright yellow, distant near the centre, in narrow rays near the bark, medullary rays broad, parenchyma filled with starch; bryonia has thin bark, cork thin, friable, wood-bundles small, numerous, in rays and concentric circles, surrounded by thin-walled parenchyma. See pages 217, 606.

4. *Belladonna from Inula*.—Belladonna has thickish bark, no bast fibres, wood-bundles central, small, distinct, surrounded in the thicker roots by broader wood-wedges, and equally wide medullary rays; inula has a broad bark of small cells, radially arranged, with a distinct light circle of cambium between the bark and the wood area, which latter is made up of a large proportion of soft cells radially arranged and many large wood-vessels in rows. Both in the bark and the wood area there are many large openings of resin-ducts. Inula contains inulin deposited as spheres in the cells, while belladonna has much starch over the whole section. See pages 539, 619.

5. *Ipecac from Spurious Ipecacs*.—Ipecac has quite a regular bark of isodiametric cells containing starch; some of the cells contain oxalate raphides (needles), particularly in the inner bark. The wood is radiate, with medullary rays hardly distinguishable from the wood-cells in shape, but containing starch-grains. False roots have thick bark, no starch. See pages 568, 573.

6. *Pareira from False Pareiras*.—Pareira has thin bark, wood in several concentric circles, waxy cut, wood-wedges porous, uniform, numerous, separated by wavy circles of waxy parenchyma-tissue resembling medullary rays, stem with central pith. False roots have hard wood in eccentric circles, fresh cut not waxy. See pages 214, 216.

**II. Rhizomes.** 1. *Veratrum Viride* from *Cypripedium*.—*Veratrum viride* has one-seventh diameter in cortex consisting of parenchyma having starch, sometimes calcium oxalate, few wood-bundles, one-eighth inch from outside has brownish wavy nucleus-sheath, centre with many wood-bundles; *cypripedium* has thick cortex, indistinct nucleus-sheath, wood-bundles approximate, more distinct centrally, parenchyma has starch. See pages 98, 135.

2. *Arnica* from *Strawberry*.—*Arnica* has thick bark, thin cork, circle of resin-cells, wood-wedges in a close circle enclosing large pith; strawberry rhizome has no resin-cells, but contains starch. See page 629.

3. *Serpentaria* from *Spigelia*.—*Serpentaria* has thin bark containing some oil-cells, wood-wedges longest on under side, separated by broad medullary rays, pith large-celled; *spigelia* has thin bark, divided into two distinct layers, an inner third and outer two-thirds; wood-circle thickest on under side, radiate, continuous except usually at one end where wood is missing, medullary rays hardly visible. Pith oval and sometimes decayed; resin-spots in wood, especially around pith. See pages 174, 485.

4. *Hydrastis* from *Caulophyllum*.—*Hydrastis* has thick bark, broad wood-wedges, not fixed in number (often 10), decidedly yellow; medullary rays broad, yellow, pith large, both, like the bark, contain starch; *caulophyllum* has thin bark, wood-wedges not so long as in *hydrastis*, medullary rays broad, pith large, parenchyma contains starch. See pages 194, 214.

5. *Helleborus Niger* from *Helleborus Viridis*.—*Helleborus niger* has bark thick, circle of 8 wood-wedges, broad medullary rays, pith large; *helleborus viridis* has circle of 4 wood-wedges, broad medullary rays. See page 198.

**III. Woods.** 1. *Guaiacum* from *Santalum Album*.—*Guaiacum* consists mostly of wavy interwoven wood-fibres, numerous 1-rowed medullary rays, large single ducts and narrow lines of wood, parenchyma in 1-2 rows of irregular and interrupted circles—all cells contain resin; *santalum album* has ducts single, moderate size, wood-parenchyma narrow, contains volatile oil or calcium oxalate, medullary rays narrow, in 1-2 rows. See pages 172, 347.

2. *Santalum Rubrum* from *Hæmatoxylon*.—*Santalum rubrum* has large ducts, 1-rowed medullary rays, wood-parenchyma 4-rowed in interrupted, irregular circles, cells with red resinous coloring matter, parenchyma with calcium oxalate crystals; *hæmatoxylon* has large ducts, often in groups of 2, medullary rays 2-rowed, wood-parenchyma in broad, wavy, circular lines, coloring matter in wood-fibres and ducts. See pages 303, 320.

**IV. Barks.** 1. *Cinchona Calisaya* from *Cinchona Succirubra*.—*Cinchona Calisaya* has very few, if any, stone- (resin-) cells, old bark with prominent secondary cork, medullary rays narrow, bast fibres single, sometimes in groups of 2, rarely more, medium sized; *cinchona suc-*

cirubra has no stone-cells, medullary rays narrow, bast fibres medium, in lines 2 to 5, seldom 8. See pages 575, 576.

2. *Quillaja from Ulmus*.—Quillaja has crystals of calcium oxalate on the cross-section or on the broken splintery fracture, also starch-grains; slippery elm has fracture fibrous mealy, very little starch, but no calcium oxalate. See pages 159, 271.

V. Fruits. 1. *Anise from Conium*.—Anise has flat face, 5 light brown filiform ridges, also 15 or more thin oil-tubes; conium has 5 crenate ribs but no oil-tubes. See pages 446, 452.

2. *Fennel from Caraway*.—Fennel has 5 obtuse, conspicuous ribs, 4 oil-tubes on back, 2–4 on flat face; caraway has 5 filiform ribs, 6 oil-tubes. See pages 443, 448.

VI. Seeds. *Stramonium from Black Mustard and Colchicum*.—Stramonium has albumin whitish, oily, enclosing cylindrical embryo, curved parallel with edge of seed; mustard has oily embryo, radicle curved, 2 cotyledons, one folded over the other; colchicum has albumin oily, horny, tough, enclosing small embryo opposite hilum, monocotyledonous. See pages 116, 254, 553.

VII. Powders. 1. *Starches*.—Each starch has a characteristic-sized and shaped granule dependent upon its source. As these, therefore, all differ, we have only to take several  $\frac{1}{4}$  gr. (.016 Gm.) samples of a specimen and add to each a drop of water on a slide under a cover-glass—with  $\frac{1}{8}$ -inch objective we can recognize readily the predominating starch and identify all possible starchy adulterations: corn-starch (*official*, pages 82, 84) is mostly in pentagons and hexagons; rice-starch (page 85) similar, but only one-fifth size; wheat-starch (page 84), lenticular layer indistinct, hilum central, third larger than corn-starch; also notice starches of maranta (pages 84, 129), canna (page 130), curcuma (pages 85, 134), sago (pages 85, 93), ginger (page 130), cassava (pages 85, 387). All starches turn blue with iodine and swell with potassium hydroxide solution or diluted sulphuric acid.

2. *Ginger from Corn- and Wheat-starch*.—Ginger contains normally about 20 p. c. of its own peculiar starch, whose granules are flat and broadly ovate, but when seen edgewise look long and narrow, with small hilum near narrow end, marked by many transverse lines. Resemble but are smaller than granules of E. India arrowroot; corn- and wheat-starch added increase the amount beyond 20 p. c., and can be recognized by their characteristic shapes. See pages 84, 130.

3. *Cloves from Powdered Shells and Starch*.—Cloves is very simple, consisting of fragments of parenchyma-cells, having thin walls and a faint yellow color; a few long, stout, colorless bast fibres and some small spiral vessels; no starch; shells consist of thick-walled stone-cells, lignified, with pore-canals, etc. See pages 84, 432.

4. *Taraxacum from Chicory*.—Taraxacum consists of clear white fragments of parenchyma-cells, with occasional large vessels approach-

ing the scalariform in type; chicory is similar to taraxacum, except that the vessels are slightly smaller and more reticulate. Some latex tubes may also be seen. See pages 609, 611.

5. *Digitalis from Senna*.—*Digitalis* has numerous multicellular hairs, which, having constrictions, appear to be formed of a number of elongated cells; *senna*, on the contrary, has many unicellular hairs having thick and rough cell-walls. See pages 293, 559.

6. *Stramonium from Tobacco*.—*Stramonium* has multicellular hairs somewhat resembling *digitalis*, while tobacco also has multicellular hairs, some having glands at their free extremities. See pages 553, 555.

7. *Kamala from Lupulin*.—*Kamala* consists of stellately arranged colorless hairs mixed with depressed globular glands, containing 40–60 club-shaped vesicles; *lupulin* consists of minute granules, subglobular or hood-shaped, reticulate, lower half obtusely conical. See pages 164, 390.

8. *Lycopodium from Pine-pollen*.—*Lycopodium* consists of granules that are tetrahedral, reticulated, rounded on one side and on the edge, with short projections; *pine-pollen* consists of an elliptic cell, at each end of which is attached a globular cell. See pages 66, 67.



## APPENDIX.

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### POISONS—TREATMENT AND ANTIDOTES.

POISONING may be of two kinds: 1. Chronic, where small doses are repeated at more or less short intervals, thereby slowly establishing characteristic symptoms (arsenic, bromides, iodides, lead, etc.). A few drugs have been termed "criminal poisons," because when thus given they produce effects partly imitative of certain diseases, hence preclude ready conviction of the guilty (arsenic, colchicum, tartar emetic, etc.). 2. Acute, where a single excessive dose is taken, which quickly produces alarming conditions, and it is this phase of the subject that should be understood as here considered.

Some poisons produce specific symptoms; others have a more complex action, and consequently require a general treatment for antagonization; a few, being absorbed quickly, show almost immediate effect (hydrocyanic acid, strychnine, nicotine, reptile-venom, gases, etc.), while nearly all give evidence of gradual ingestion within at least 15–30 minutes. All demand prompt medication and imply doubtful recovery; therefore, in order to use all possible haste, both physicians and pharmacists should consider it imperative not only to have in mind the antidotes and specific treatments, but at ready command the many combating remedies. These are called antidotes, and may be: (1) mechanical, which simply protect the stomach walls from the poison (starch, flour, demulcents, oil, etc.); (2) chemical, which by combination form less soluble and active compounds in the stomach (tannin, sodium and magnesium sulphates, lime water, magnesium oxide, etc.); (3) physiological, which antagonize the action of the drug after it enters into circulation (atropine—morphine, aconite—digitalis, etc.).

### RATIONALE OF TREATMENT.

Excessive quantities of poisons frequently from the first cause free vomiting and purging *per se*, thereby largely correcting their evil effects, but when neither of these occurs, vomiting should at once be induced by either zinc sulphate, mustard, pump, apomorphine, etc.; next administer the proper chemical antidote (if one exists), or physiological antagonists (incompatibles), awaiting thereafter 15 minutes; now produce emesis, and wash out stomach with warm or warm-medicated water; finally treat functional and organic symptoms (respiration, circulation, temperature) that may necessarily arise. In depressing poisons, as well as corrosive substances, emetics should be used cautiously, lest by wrenching we occasion greater exhaustion and



possibly a rupture of the impaired stomach-wall; here the pump or siphon-tube is to be preferred. The bladder should frequently be emptied, if necessary by catheter, and in many cases a quick-acting cathartic is of considerable advantage. Diffusible (cardiac) stimulants, artificial respiration, electricity, artificial heat, etc., all are at times of great service.

While it is true that the majority of poisons demand specific and different treatment, yet for simplicity' sake a few groups can be formed, each containing drugs amenable to like antagonism, thus—alkalies and alkaline salts are combated with weak acids, albumin, demulcents; acids and acid salts with weak alkaline solutions, albumin, demulcents, oil; alkaloidal drugs with tannin, coffee, tea; depressants with stimulants and *vice versa*, etc.

#### USUAL AGENTS EMPLOYED IN POISON CASES.

1. *Jeauvel's General Antidote*.—Either of the following formulas may be employed when the nature of the poison is doubtful, or for arsenic, digitalis, mercuric salts, opium, strychnine, and zinc salts, but is of no value for antimony compounds, caustic alkalies, or phosphorus:

R. Liquor Ferri Tersulphatis,	℥ijss	(75 Cc.)	
Magnesii Oxidum,	℥ij	(60 Gm.)	
Carbo Animalis,	℥j	(30 Gm.)	
Aqua Fontana,	℥xxx	(600 Cc.).	M.

Keep the three last ingredients always mixed, and add liquor when needed. Dose. ℥ij-3 (60-90 Cc.).

R. Magnesii Oxidum,	℥ij	(60 Gm.)	
Carbo Ligni,	℥ij	(60 Gm.)	
Ferri Hydroxidum,	℥ij	(60 Gm.)	
Aqua Fontana,	℥xij	(360 Cc.).	M.

Dose, *ad libitum*.

2. *Albumin, White of Egg*.—Dissolve 4 egg-whites in a quart of warm water—for mineral acids, mineral salts (corrosive sublimate, etc.), corrosive alkalies, aniline, creosote, bromine, chlorine, iodine, etc.

3. *Milk, Fatty Oils, Mucilaginous Substances*.—Substitutes for albumin—for corrosive salts, corrosive acids and alkalies (especially ammonia), but the first two never for cantharides (phenol—carbolic acid), copper salts, or phosphorus, whose absorption they promote.

4. *Castile Soap*.—Dissolve in 4 volumes of water, as a substitute for albumin—for corrosive acids, metallic salts (corrosive sublimate, potassium dichromate, tin and zinc salts), corrosive vegetable substances; harmful in alkaline poisoning, hence not to be used. Dose, ℥ij-12 (60-360 Cc.).

5. *Tannic Acid, Coffee, Tea*.—To precipitate the various alkaloids as insoluble tannates; *Potassium Permanganate*—for morphine, codeine, etc.; *Dialyzed Iron*—for arsenic; *French (Old) Oil of Turpentine*—as physiologic antidote for phosphorus; *Ammonia Water, Aromatic Spirit of Ammonia, Brandy, Whisky, Amyl Nitrite, Faradic Battery, etc.*—for general stimulation.

6. *Vinegar, Diluted Mineral Acids*.—To neutralize alkalies and alka-

line salts; *Magnesium Oxide*, *Sodium Bicarbonate*, *Calcium Carbonate*, *Sodium and Magnesium Sulphates*—for various acids and acid salts; *Charcoal*, animal and vegetable—for arsenic, corrosive sublimate, etc.; *Hydrated Chloral*, *Chloroform*, *Ether*, *Potassium Bromide*—as narcotics or anæsthetics in tetanic poisoning.

7. *Emetics*: (1) Zinc Sulphate, gr. 5–15 (.3–1 Gm.), repeated twice if necessary, at 15-minute intervals, or until emesis is produced; (2) Mustard, ʒj–4 (4–15 Gm.), stirred to a cream with water; (3) Ipecac, gr. 15 (1 Gm.), repeated if necessary in 15 minutes; Apomorphine Hydrochloride, 2 p. c. solution, ℥ij–5 (.2–.3 Cc. hypodermically); Stomach Pump, or Rubber Tubing (5–8 feet of  $\frac{1}{2}$  inch); Tartar Emetic, gr.  $\frac{1}{2}$  (.03 Gm.) in sweetened water, for children.

8. *Hypodermic Solutions*: (1) Atropine Sulphate, 1 p. c., ℥ij–6 (.13–.4)—as physiologic antidote for aconite, benzene, gelsemium, morphine, muscarine, opium, physostigmine, pilocarpine, etc.; (2) Pilocarpine Nitrate, 5 p. c., ℥x–15 (.6–1 Cc.)—as physiologic antidote for atropine, scopolamine, daturine, duboisine, hyoscyamine, etc.; (3) Morphine Sulphate, 10 p. c., ℥v–8 (.3–.5 Cc.)—for similar use as pilocarpine nitrate; (4) Strychnine Sulphate or Nitrate, 2 p. c., ℥ij–3 (.13–.2 Cc.)—as physiologic antidote for most depressants: acetanilide, aconite, hydrated chloral, chloroform, conium, physostigma. All of these should be used in an aseptic hypodermic syringe.

In cases of specific poisoning the following treatments are recommended:

*Acetanilide*, *Antifebrin*, *Antipyrine*, *Phenacetin*: Empty stomach, place in recumbent position, supply abundant fresh air or oxygen (for cyanosis, loosen clothing around neck, chest, and waist, stimulants (brandy, whisky, ammonia), external heat, atropine or belladonna (to maintain blood-pressure), strychnine to aid respiration.

*Acids*: If these have been taken in concentrated form, it is unwise to give emetics or use the pump, as either might tend to lacerate the softened œsophagus.

1. *Chromic*, *Potassium Chromate* and *Dichromate*: Emetics, then magnesium oxide or carbonate, sodium bicarbonate or borate, chalk in water to a paste, demulcent drinks (flaxseed, elm, etc.), stimulant enemas.

2. *Hydrocyanic*—*Cyanides*, *Oil of Bitter Almond*, *Cherry Laurel Water*: Recumbent position, abundant fresh air, oxygen, smell chlorine water or diluted chlorine gas, vomit, hypodermic atropine for heart, brandy, ether, ammonia inhalations; if breathing ceases, use artificial respiration, mild faradic current to the heart, alternate cold and warm affusions to head, chest, and spine; ferrous and ferric sulphates followed by potassium carbonate solution yield insoluble Prussian blue (antidote), ferrous sulphate alone or with magnesium oxide renders acid insoluble, but the action of the acid is so quick that, as a rule, antidotes avail little; ℥xv (1 Cc.) of official acid, or gr. 1 (.06 Gm.) of anhydrous acid, usually is fatal in 15 minutes.

3. *Mineral*—*Hydrochloric*, *Nitric*, *Nitrohydrochloric*, *Sulphuric*, *Phos-*

*phoric, Glacial Acetic*: Neutralize with an alkaline solution—sodium, potassium, magnesium carbonate or bicarbonate, magnesium oxide, lime, chalk or wall-plaster ( $H_2SO_4$ ), dissolved or mixed with water, soap-suds, water freely, except with sulphuric, then demulcent, drinks gruel, egg-white, almond or olive-oil, warmth and friction to extremities (feet, hands), emollient fomentations, brandy and whisky for collapse, morphine for pain.

4. *Oxalic—Oxalates, Salt of Lemon (Potassium Oxalate)*: Unless the poison has occasioned vomiting, empty stomach at once, then neutralize with chalk, whiting or wall-plaster in creamy paste with water, lime water, now vomit to get rid of insoluble calcium oxalate, give demulcent drinks, oils, opium for pain, hot fomentations to abdomen, friction to extremities (feet, hands), enema, much water to hasten elimination by kidneys; avoid potassium and sodium (alkaline) carbonates, as they form soluble oxalates;  $\text{℥ss}$ –1 (15–30 Gm.) usually proves fatal.

*Aconite, Aconitine, Pulsatilla*: Evacuate and wash out well the stomach, unless symptoms severe, when vomiting should be avoided, if possible, and then in a towel without raising head; place in recumbent position, with absolute quietness, feet elevated (to confine circulation to vital centres at base of brain), dry warmth to body, especially extremities (feet, hands), cardiac (diffusible) stimulants (brandy, whisky, alcohol, ether, ammonia) by mouth or skin, digitalis for heart syncope (tincture  $\text{℥xxx}$ ; 2 Cc.), hypodermic atropine ( $\text{℥iv}$ ; .26 Cc.) or strychnine (gr.  $\frac{1}{20}$ – $\frac{1}{10}$ ; .003–.006 Gm.) for cardiac and respiratory stimulation, tannin, amyl nitrite, oxygen, artificial respiration. Tincture of aconite  $\text{℥xxx}$ –60 (2–4 Cc.), and aconitine gr.  $\frac{1}{20}$  (.003 Gm.), have each proved fatal.

*Alcohol, Alcoholism, Delirium Tremens*: Drunkenness resembles somewhat opium-poisoning and brain concussion. Empty stomach, washing it out well with strong warm coffee, apply warmth to body and extremities (feet, hands), cold douche to head, plenty fresh air, interrupted current to respiratory muscles, inhale ammonia, amyl nitrite, artificial respiration, keep awake mechanically.

*Alkalies, Potassium and Sodium Hydroxide, Ammonia, Spirit of Hartshorn, Ammonia Smelling-salts, Carbonates*: Neutralize with vinegar, lemon-juice, diluted acetic acid, then give demulcent drinks, fatty oils, opium to relieve pain. For ammonia gas inhale warm acetic acid vapor, and lessen chest-pain by a few chloroform inhalations.

*Alkaloids*: Empty stomach at once, follow with tannin solution or strong coffee, tea to form insoluble tannates.

*Alum*: This usually vomits *per se*, otherwise give emetic, then ammonium or potassium carbonate, demulcents.

*Aniline (Dyes, Ink)*: Vomit with copper sulphate, or wash out well the stomach with warm water, place in recumbent position, loosen clothing, abundant fresh air, oxygen, ether injections, ammonia, whisky, brandy, strychnine, magnesium oxide (gr. 30; 2 Gm.);  $\text{℥ss}$ –2 (2–8 Gm.) have proved fatal.

*Antimony, Chloride, Wine, Tartar Emetic*: These usually vomit actively *per se*; if not should empty stomach, giving abundance of warm water, follow with tannin solution, coffee, tea, gallic acid (to form insoluble tannates), demulcent drinks, egg-white, milk, warmth, friction, faradic current over heart, opium and stimulants in small and frequent doses, artificial respiration; magnesium and sodium carbonates may be used, also ferric hydroxide followed with opium or morphine for pain; magnesium oxide in milk for the chloride; Tartar Emetic, gr. 2–5 (.13–.3 Gm.) have killed, much larger doses often have failed.

*Arsenic, Paris Green, Fly-stone or -powder, Fowler's Solution, Rough on Rats, Cobalt*: Produce emesis if it has not occurred, washing out the stomach with much water, then give freshly precipitated ferric hydroxide, made by double decomposition between any ferric solution well diluted, and either ammonia water well diluted, sodium carbonate, or magnesium oxide, the object being to envelop the poison mechanically and to form insoluble ferric arsenite or arsenate; usually give 3j (4 Gm.), every 5 minutes, for 8 doses, and follow with zinc sulphate, then castor oil; may give oils, demulcent drinks, egg-white, and stimulants for faintness and great depression, warmth to body, opium or morphine for pain, poultices and fomentations to stomach, flour, lime water, dialyzed iron, subcarbonate of iron, alkaline mineral waters.

*Belladonna, Scopolia, Hyoscyamus, Stramonium, Duboisia, Dulcamara (Atropine, Scopolamine, Hyoscyamine, Daturine, Duboisine, Solanine)*: Empty stomach, give tannin solution, strong coffee, tea by mouth or rectum, hypodermic morphine, physostigmine or pilocarpine (to antagonize nervous disturbance, delirium, etc.), then diffusible stimulants (whisky, brandy, ammonia), caffeine, strychnine, cold to head, warmth and friction to extremities (feet, hands), artificial respiration.

*Benzene, Nitrobenzene, Oil of Mirbane*: Empty stomach, give plenty fresh air, hypodermic atropine, alternate cold and hot water douches to chest, mild faradic current over heart, artificial respiration.

*Bites. 1. Dogs, Cats*: At once suck forcibly the wound, endeavoring also by squeezing to force out all blood possible, wash with warm water, and cauterize well with lunar caustic; 2. *Snakes*: Apply cupping-glass over wound, or tie the limb moderately tight above injured spot, allow to bleed freely, aiding by pressure, wash with warm water and cleanse thoroughly, cauterize with mineral acids or phenol (carbolic acid); apply potassium permanganate solution (5–10 p. c.), ammonia water, tincture of iodine; cause perspiration by warm drinks, ammonia, wine, arsenic; one with perfect mucous surface should forcibly suck wound; if much prostration, give liberally of diffusible stimulants (whisky, brandy, ammonia); bleed at one arm, transfuse blood or "normal salt solution" by the other; 3. *Insects, Bees, Wasps, Hornets*: Apply locally ammonia water or some alkaline solution, may saturate cloth with ammonia water or sodium chloride solution and lay over part until pain dispelled; remove sting by pressing a watch-key over it. give stimulants (ammonia, wine, etc.), may apply onion to wound, but not of much value.

*Bromal Hydrate*: Large doses kill in a few minutes, with contracted pupil, dyspnoea, and convulsions, death from failure of respiration; acts on heart muscle direct, much more powerful than hydrated chloral. Inhale abundant fresh air, ammonia, empty stomach, cardiac stimulants (strong coffee, alcohol, caffeine, digitalis), cold to head, warmth to extremities, strychnine, electricity, amyl nitrite, artificial respiration, quietness.

*Bromine, Bromides*: For bromine, if swallowed, give well-diluted ammonia water, olive or almond oil; if inhaled, then breathe ammonia vapor and abundant fresh air, for bronchial irritation inhale a little chloroform. For bromides give cardiac stimulants (strong coffee, caffeine citrate, digitalis), morphine is the best antagonist for mental symptoms, may give strychnine, ergot, belladonna, cathartics, diuretics.

*Camphor*: Empty stomach, give alcohol or brandy in small and frequent doses (best hypodermically), coffee, ether inhalations, alternate hot and cold douche, warmth to extremities by hot blankets, etc., opium and bromides for convulsions.

*Cannabis Indica*: Somewhat similar to opium and hydrated chloral. Emetics, lemon-juice to neutralize, tannin, hot coffee, hypodermic atropine (gr.  $\frac{1}{128}$ ; .00054 Gm., every 15 minutes for 3 doses), ammonia, strychnine, electricity to chest muscles, artificial respiration, keep awake, also body warm, empty bladder often.

*Cantharides, Cantharidin*: Empty stomach, give demulcent drinks freely (barley, elm, flaxseed tea, diluted egg-white, gruel or pure water), hypodermic morphine or tincture of opium (by mouth or rectum) to allay pain and gastro-enteritis; avoid oils and oily emulsions, as these favor solubility and absorption of cantharidin, stimulants, warmth to extremities, warmth and cataplasms to abdomen; powdered drug ʒss (2 Gm.) or tincture ʒj (30 Cc.) usually proves fatal.

*Carbon Disulphide*: Vomit, give potassium bromide and hydrated chloral (for nervous excitement), stimulants (to support circulation), inhale ammonia, warmth to body, cold douche to head, artificial respiration.

*Castor Beans*: Vomit at once, give demulcent drinks, opium for pain and to quiet violent symptoms, which resemble those of cholera; 3 seeds, also 20, have each killed in 2 and 5 days.

*Chloroform, Ether, Nitrous Oxide Gas*: Withdraw at once the source, lower well the head, pull tongue forward, to admit fresh air, compress and relax chest, ammonia and amyl nitrite inhalations, warmth and friction to extremities, hot and cold douche, weak current—one pole on the larynx, other on the pit of stomach; if heart stopped, give several taps over that region, inhale, ammonia, brandy, atropine, strychnine, artificial respiration. If swallowed, treat as hydrated chloral; vomit, enema of hot coffee, draughts of water containing sodium carbonate or bicarbonate, ammonia, warmth; chloroform inhalation kills 1 in every 3,000; ether, 1 in every 16,000; nitrous oxide gas, 1 in every 300,000.

*Chlorates, Nitrates (Potassium, Sodium, etc.)*: Vomit, plenty of

water and demulcent drinks for dilution, amyl nitrite, opium for pain, hot fomentations to loins; avoid stimulants (increase kidney congestion);  $\text{zviij}-12$  (30–45 Gm.) usually prove fatal in a few hours.

*Chlorine Water, etc.*: Give emetic, warm water, then milk, egg-white (albumin), flour with water or lime water, ammonia water.

*Cocaine, Eucaïne*: Similar to belladonna, etc., as they closely resemble atropine in action on pulse, pupils, respiration, sweat-glands, and bowels. Empty stomach, give tannin, morphine (best antidote), then in sequence hydrated chloral, chloroform, ether, alcohol, amyl nitrite to stimulate heart, strychnine, artificial respiration, caffeine, ammonia inhalations.

*Colchicum* (*Wine, Tincture, Extract, Fluidextract, etc.*): Unless vomiting and purging already have occurred, induce at once the former, give tannin (gr. 30; 2 Gm.), gallic acid, strong coffee or tea, abundant water, demulcent drinks, morphine or opium to allay pain, purging, and heart depression, cardiac (diffusible) stimulants, hot fomentations to abdomen, keep extremities (feet, hands) warm; powdered root gr. 50 (3.3 Gm.), seeds  $\text{ziv}$  (15 Gm.), root wine  $\text{ziv}$  (15 Cc.), have each proved fatal.

*Conium, Coniine*: Emetics or lavage, tannin, strong coffee, tea, again wash out stomach, external warmth (hot wraps, bags, bottles, etc.), epispastics, alcohol, stimulants, strychnine, picrotoxin, hypodermic atropine, artificial respiration, castor oil; coniine  $\text{Mj}-2$  (.06–.13 Cc.) usually fatal in 1–3 hours.

*Colocynth, Elaterium, Elaterin*: Empty stomach, give demulcent drinks, enemata, opium for pain (small doses), warm bath, stimulants (brandy, whisky, etc.).

*Croton Oil*: Empty stomach, give hypodermic morphine or laudanum, every 20 minutes until pain and purging abated, demulcent drinks, mucilage, milk, egg-white, olive oil, soup, spirit of camphor, stimulants, warmth and friction;  $\text{zss}-2$  (2–8 Cc.) have killed in 4–6 hours.

*Curarine, Woorare, Urare*: If wounded, ligate above injury, suck forcibly, and wash well with alkaline solution (potassium permanganate), warmth to loins, abundant water, spirit of nitrous ether (to aid urine elimination), artificial respiration, empty bladder often; resembles digitalis much more than it does strychnine.

*Digitalis, Convallaria, Scoparius, Strophanthus, Apocynin, Scillain, Scillitin*: Vomit or wash out the stomach well with warm water and tannin, strong coffee, tea; keep reclined, never allowing erect position, as that may cause fatal syncope; aconitine (gr.  $\frac{1}{100}$ ; .0003 Gm.), or tincture of aconite ( $\text{Mv}$ ; .3 Cc.) best for large quantities, opium best following prolonged usage, saponin and senegin best physiological antagonist, diffusible stimulants by mouth or rectum, warmth and friction to extremities (feet, hands); powdered drug  $\text{zss}$  (2 Gm.), tincture  $\text{zij}-4$  (8–15 Cc.), have proved fatal.

*Ergot*: Empty stomach, give plenty warm drinks, tannin, coffee, tea, quick purgative (croton oil  $\text{Mj}$ ; .06 Cc.), recumbent position,

small doses of opium at intervals for pain and irritation, nitroglycerin occasionally (gr.  $\frac{1}{50}$ ; .0013 Gm.), hot baths, warmth, friction to maintain circulation), stimulants, amyl nitrite.

*Gamboge, Scammony*: If vomiting and purging have not occurred, induce former by usual emetics, may give solution of potassium or sodium carbonate, magnesium oxide in milk, demulcent drinks, and enemas, opium in small doses to allay pain and purging.

*Gelsemium, Gelsemine*: Emetic or wash out stomach with tannin solution, then hypodermic atropine and morphine, warmth and friction, cardiac stimulants (digitalis, alcohol, coffee, ammonia), artificial respiration, electricity, rouse patient by cold and hot douche; fluid-extract 3j (4 Cc.), or tincture 3iv (15 Cc.), are usually fatal.

*Gases*: 1. *Chlorine*: Inhale cautiously ammonia or hydrogen sulphide, steam often valuable for breathing, abundant fresh air, egg-white, milk, flour, lime water, demulcent drinks, chloroform or ether inhalations for cough; 2. *Hydrogen Sulphide*: Chlorine gas well diluted with air cautiously inhaled, fresh air; 3. *Illuminating-gas, Carbon Dioxide, Carbon Monoxide*: Remove clothing, open doors and windows, abundant air, oxygen, horizontal position, alternate cold and warm douche to chest and head, ammonia inhalations, diluted chlorine gas carefully breathed, faradic current to extremities, alcohol by mouth or rectum, strong coffee by enema, artificial respiration, venesection, warmth to body and limbs, place in bed, direct quietness, circulating air, cold acid drinks freely.

*Glass—coarse or powdered*: Large quantity of bread-crumbs as an envelope, then emetics.

*Hydrated Chloral*: Empty stomach, give coffee by mouth or rectum (using tube if necessary), abundant fresh air, friction, cataplasms to limbs and over heart, hypodermic strychnine or picrotoxin every 15 minutes, keep awake by coffee, caffeine, flagellation, shaking, shouting, ammonia to nostrils, cold to head; if serious, place in recumbent position, absolute rest, amyl nitrite inhalations (to stimulate heart), artificial respiration; 3ss-1 (2-4 Gm.) has killed.

*Hyoscine*: Similar to belladonna, but hydrated chloral is used here with great advantage.

*Iodine*: Give starch in hot water, or flour in warm water, farinaceous substances (rice, arrowroot, gruel, etc.), then vomit, demulcent drinks, egg-white in milk, sodium bicarbonate, stimulants (alcohol, digitalis, amyl nitrite), atropine, strychnine, opium or morphine for pain.

*Ipecac*: Unless thoroughly vomited, empty stomach, washing it out with tannin solution, if necessary follow with opium, belladonna, cardiac (diffusible) stimulants.

*Iodoform, Iodol, Aristol*: Give potassium bromide, to dissolve iodine compound, lemonade, potassium acetate solution, stimulants, diaphoretics, warm sponge bath, small repeated doses of tincture of opium, large doses of potassium bicarbonate, diluents freely.

*Lead and Barium Salts*: Give magnesium or sodium sulphate (3ss; 15 Gm.) in a glass of water to form insoluble sulphate, then vomit,

follow with purgative enema, demulcent drinks, milk, egg-white, diffusible stimulants, opium for pain; for lead colic apply hot-water bag, hot fomentations; for chronic lead-poisoning, recognized by blue line (sulphide) along margin of gums, drop-wrist (extensors paralyzed), constipation, etc., give iodides to saturation (sodium and calcium being best), sulphur or sulphurated potassa baths, sulphuric acid, friction to muscles, calomel, lemonade, strychnine, faradic current.

*Lobelia*: If patient has failed to vomit, use emetic, follow with tannin, cardiac and respiratory stimulants, strychnine or picrotoxin hypodermically, opium, thebaine, alcohol, digitalis, atropine, ergot; caustic alkalis decompose lobeline, also preparations; ʒj (4 Gm.) has killed.

*Mercury and Copper Salts* (*Corrosive Sublimate, Nitrate, White Precipitate, etc.*): Give egg-white, beaten up with water (1 egg for every 4 grains (.26 Gm.) of corrosive sublimate), follow with emetic at once, to avoid re-solution, after this demulcent drinks, stimulants, warmth, friction, opium or morphine for pain; in the absence of egg-white, use flour-paste, or milk, or meat-broth; for copper salts may give additionally reduced iron, weak solution of potassium ferrocyanide, then potassium iodide until system saturated to promote elimination; tannin, strong coffee, tea useful in combating these metallic salts; for salivation, use bismuth, sodium sulphite, weak nitric or sulphurous acid, belladonna to diminish ptyalism; corrosive sublimate gr. 3–5 (.2–.3 Gm.) are usually fatal in  $\frac{1}{2}$ –2 days; copper sulphate and acetate, ʒviii (30 Gm.) and ʒiv (15 Gm.), respectively, have killed in 4–12 hours.

*Mezereum*: Evacuate stomach with warm albuminous or mucilaginous drinks, then milk, fatty oils, demulcent enemas, opium for depression, cold poultices to abdomen.

*Mushrooms, Poisonous Fungi, Muscarine*: Empty stomach, give hypodermic atropine or tincture of belladonna, tannin, castor oil and enema to remove fungi from lower bowel, alcoholic stimulants, warmth, friction, poultice to abdomen.

*Nitroglycerin, Amyl Nitrite*: Give atropine, strychnine, picrotoxin, digitalis to increase functional activity of spinal cord and sympathetic system, stimulants, artificial respiration, alternate cold and hot douche to head, ergotin.

*Opium, Lactucarium, Morphine, Codeine, Laudanum, etc.*: If taken by mouth, give at once  $\frac{1}{2}$  p. c. solution of potassium permanganate (ʒviii; 240 Cc.), then empty stomach by pump, apomorphine, etc., washing it out well with strong hot coffee, leaving therein at least a pint (.5 L.), tannin solution, keep body warm but alternate hot and cold douche to the head, hypodermic atropine and strychnine as respiratory stimulants (every 15 minutes for 3 doses), electricity to chest muscles, artificial respiration, digitalis as heart stimulant, ammonia inhalations, amyl nitrite, keep awake by shaking, flicking with a towel, cold water over face and chest, walking between attendants; evacuate bladder often to prevent reabsorption. If poison taken hypodermically, proceed as outlined, omitting chemical antidote and vomiting; opium gr. 5 (.3 Gm.), or morphine gr. 1 (.06 Gm.), usually prove fatal in 5–12 hours.



*Phenol (Carbolic Acid), Creosote, Resorcinol*: The pneumogastric filaments, in mucous membrane of the stomach, are usually so obtunded as not to respond to emetics, so if considered safe, empty stomach with pump or hypodermic of apomorphine, or give as soon as possible alcohol  $\bar{\text{iv}}$  (120 Cc.) mixed with equal quantity of water, remove at once by emetic or tube, repeat this every 5–10 minutes for 4 to 8 times; alcohol stimulates and protects stomach from corrosive action of poison, may employ diluted acetic acid for alcohol; or may wash out the stomach with 10 p. c. solution sodium bicarbonate ( $\bar{\text{viiij}}$ ; 240 Cc.), following with antidote—magnesium or sodium sulphate ( $\bar{\text{ij}}$ ; 60 Gm.), in weak solution, to form harmless sulphophenolate, then demulcent drinks, egg-white (to protect mucous surfaces), but no oils or glycerin: stimulate with whisky, brandy, alcohol, ammonia, and if necessary digitalis, strychnine, warmth and friction to extremities (feet, hands), counter-irritants to abdomen, opium for pain, atropine. To local abrasions apply sodium carbonate solution, using same for mouth-wash; the brownish or blackish urine and eschars serve to identify this poison.

*Phosphorus, Rat Paste, Matches*: Empty stomach, preferably with copper sulphate (gr. 3; .2 Gm., repeated 2–4 times at 5-minute intervals) to form insoluble black phosphide, follow every half hour with old viscid (oxygenated, acid, French) oil of turpentine ( $\bar{\text{ij}}$ ; 4 Cc.), floated on water, follow with magnesium sulphate ( $\bar{\text{ij}}$ –3; 30–90 Gm.) in a glass of water as a cathartic; may give hydrated magnesia, lime water, charcoal. If the phosphorus be taken in solution, give potassium permanganate to cause oxidation, opium for pain; albumin, egg-white valuable, but never fats or fatty oils, as these are solvents, hence aid its absorption; empty bladder often; phosphorus gr. 1 (.06 Gm.) is usually fatal in 1–5 days.

*Physostigma, Physostigmine, (Eserine)*: Evacuate stomach, give tannin, coffee, tea, hypodermic atropine every 15 minutes until pupils dilated and pulse strong; if this should fail, give hydrated chloral (gr. 10; .6 Gm.) at same intervals, or hypodermic strychnine, then cardiac stimulants (alcohol, coffee, digitalis, ammonia), artificial heat and respiration, electricity; empty bladder often; 6 seeds have killed.

*Phytolacca*: Similar to aconite and veratrum, but unlike the latter in that vomiting ensues much more slowly; within 2 hours usually acts *per se* as an emeto-cathartic, after which give cardiac stimulants (alcohol, ammonia, ether, digitalis, etc.), opium for pain.

*Pilocarpus, Pilocarpine*: Similar to physostigma; evacuate stomach, washing it out well with tannin solution, follow with hypodermic atropine (gr.  $\frac{1}{60}$ ; .001 Gm.), or tincture of belladonna ( $\text{Mxx}$ ; 1.3 Cc.), every 20 minutes until pupils dilated; morphine to control nausea and vomiting, cardiac (diffusible) stimulants.

*Ptomaines*: Toxic alkaloids in meat, sausage, pork, fish, lobster (canned or otherwise), poisoned game, putrescent food, cheese, etc.): Empty stomach at once, using large draughts of warm water, tannin, coffee, tea; castor oil as a purgative, after this operates give diluted

vinegar, sponging the body with some weak alkaline solution, alcoholic stimulants for depression, warmth to abdomen, friction to extremities, opium for spasms.

*Savin, Sabina Oil and Tops, Tansy and Oil:* If not already vomited, give at once an emetic, move bowels freely with Epsom salt, castor oil (full dose), stimulants, allay pain with morphine and demulcents, flaxseed meal poultice to stomach.

*Poison Oak, Ivy:* Apply at once locally soap and water with scrubbing-brush, then lead water, alkaline solutions (sodium bicarbonate, sulphite, chlorinated, diluted ammonia, soapsuds, alum curd), tincture or infusion of lobelia, grindelia, sassafras, impatiens biflora, cocaine solution, aristol, opium; internally cooling drinks, low diet, saline purgatives, quietness.

*Quinine, etc.:* Give potassium bromide, hydrobromic acid, cardiac and respiratory stimulants; morphine counteracts cerebral action, atropine the nervous, cardiac, and antipyretic effects.

*Silver Salts, Nitrate, Lunar Caustic:* Give sodium chloride (table salt)  $\text{ziv}$  (15 Gm.), dissolved in a glass of warm water to form insoluble silver chloride, or use egg-white, or milk, follow with emetic and large draughts of warm water, demulcent drinks; may use alkalies, alkaline carbonates, lime water, tannin. Following prolonged usage, give purgatives, diuretics, potassium iodide, sodium hyposulphite baths.

*Saphisagria, Stavesacre:* Similar to aconite and veratrum; evacuate stomach, then tannin, charcoal, diffusible stimulants, keep quiet, recumbent, feet elevated, extremities warm; chloroform inhalations for spasms, or hydrated chloral (gr. 30; 2 Gm.), or potassium bromide ( $\text{3j}$ –2; 4–8 Gm.); use all haste, as death is by asphyxia.

*Strychnine, Brucine, Nux Vomica, Ignatia, Picrotoxin, Cocculus Indicus, Hydrastis:* Remove patient from all noise, quickly evacuate stomach, give tannin (gr. 30; 2 Gm.) dissolved in water, or iodide of starch to form insoluble strychnine perhydroiodide, charcoal; control spasms by inhaling chloroform or ether, or by large doses of hydrated chloral and potassium bromide in solution by mouth or rectum, thus keeping up mild narcosis for several hours if necessary; spasms may stop respiration, hence control these at all risk, amyl nitrite, artificial respiration, soluble iodides, tobacco, opium, physostigmine, atropine, conium, Indian hemp; empty bladder often; nux vomica gr. 30 (2 Gm.), or extract gr. 3 (.2 Gm.), or strychnine gr.  $\frac{1}{2}$ –1 (.03–.06 Gm.), is each usually fatal in  $\frac{1}{4}$ –3 hours.

*Tobacco, Nicotine:* Induce vomiting if not already accomplished, give quietness, recumbent position, tannin, strong coffee, tea, then an emetic, hypodermic strychnine (physiological antidote) or tincture of nux vomica by mouth, diffusible stimulants alcohol, brandy, whisky, ether, etc.), warmth to body, ergot, digitalis, belladonna, iodides, artificial respiration, cold douche to head; nicotine Mxv–60 (1–4 Cc.) are fatal in 1–3 hours.

*Tin Salts:* Empty stomach, then milk of magnesia, demulcent drinks, opium for pain.

*Turpentine*: Emetics, if no purging give enema, then plenty of water and demulcent drinks, hot fomentations to loins, opium to allay pain.

*Zinc Salts, Sulphate, Chloride, Burnett's and Platt's Solutions*: Should vomiting not have occurred, give plenty warm water containing sodium carbonate or bicarbonate to form insoluble zinc carbonate, or mustard (3ij; 8 Gm.), then egg-white and milk, tannin solution, strong coffee, tea, to form insoluble tannate, opium, morphine, hot fomentations to allay abdominal pain; sulphate ʒxij (45 Gm.) are usually fatal.

*Veratrum Viride, Veratrum Album, Veratrine, Sabadilla*: Evacuate stomach, unless veratroidine constituent has thus acted, recumbent position, feet elevated, dry warmth to body (wraps, blankets, bottles, etc.), tannin, strong hot coffee, tea, cardiac (diffusible) stimulants (alcohol, brandy, ammonia, etc.), atropine to antagonize cardiac depression, strychnine as respiratory and nervous stimulant, morphine, electricity, artificial respiration.

### PRESCRIPTION-WRITING OF THE PHYSICIAN.

Prescriptions (*L. præscriptio*, a writing before, an order; *fr. præscrib(o)-ere*, to write before, to ordain) are *ex tempore formulæ* written in Latin, usually at the bedside, to combat specific conditions, and in their construction certain rules, forms, and requisites must be observed:

1. *Chirography*.—Learn to write legibly, letting your style be plain, neat, thoroughly intelligent without possible ambiguity or doubt for the compounder as to what is intended. Make this your first imperative duty, and if, when a student, your penmanship is indifferent, then at once begin the trial for improvement; this can and will alone come by careful practice, so make sure that you know how to write before knowing what to write.

2. *Prescription Blanks*.—Do not be careless as to the kind and style of paper used. It is well to have uniformity in blanks, and whenever your regular supply becomes exhausted, if possible, replenish at once, using in the interim good, white, unruled paper cut to a specific size. A neglect of this might occasion discourteous remarks somewhere along the line (by attendant, compounder, etc.), which should and can easily be avoided. Blanks are, as a rule, furnished gratuitously by the druggists (who are only too well pleased to have the number great), and in size should be neither too large nor too small, but in keeping with the boldness of individual handwriting. On the other hand, when the style and printing of those supplied are not satisfactory, then others more to one's liking should be secured from the printer at your own expense.

3. *Weights and Measures*.—Of these we may employ three systems:

1. *Avoirdupois (Imperial)*. This has the following subdivisions: grain (gr.), drachm (dr.), ounce (oz.), pound (lb.), and is thus proportioned: 27.35 grains make 1 drachm, 16 drachms make 1 ounce (437½ grs.), 16 ounces make 1 pound (7,000 grs.), 27.35—437½—7,000. By this system all substances are sold except precious stones,

precious metals, and drugs when prescribed by a physician directly or indirectly for sickness.

2. Apothecaries' (Troy). This has the following subdivisions: grain (gr.), scruple (℥), drachm (ʒ), ounce (℥), pound (lb.), and is thus proportioned: 20 grains make 1 scruple, 3 scruples make 1 drachm, 8 drachms make 1 ounce, 12 ounces make 1 pound, 20—60—480—5,760. The difference between the two pounds mentioned is 1,240 grains, the two ounces 42 grains, the two drachms 32.65 grains. The grain, however, is the same the world over, and is the *unit of weight*.

United States Fluid, Liquid, or Wine Measure. This has the following subdivisions: minim (℥), fluidrachm (f℥), fluidounce (f℥), pint (O), gallon (Cong.), and is thus proportioned: 60 minims make 1 fluidrachm, 8 fluidrachms make 1 fluidounce, 16 fluidounces make 1 pint (2 pints make 1 quart), 8 pints (4 quarts) make 1 gallon, 60—480—7,680—61,440 (58,340 grs.). The minim is the *unit of capacity*, and weighs 0.95 of a grain, the ounce weighing 455.7 grains.

Imperial Liquid Measure (Gt. Britain). This has the following subdivisions: minim (min.), drachm (fl. dr.), ounce (fl. oz.), pint (O), gallon (C): and is thus proportioned: 60 minims make 1 drachm, 8 drachms make 1 ounce, 20 ounces make 1 pint, 8 pints make 1 gallon, 60—480—9,600—76,800 (70,000 grs., or 10 lbs. Avd.). This minim weighs 0.91 of a grain, the ounce weighs 437.5 grains. It is thus seen that we have two minims (0.95—0.91 grain) and three ounces (437.5—455.7—480 grains).

3. Metric, Decimal, or French. This system is based upon the earth's polar circumference (24,818 miles), of which the one-forty-millionth part, 39.37 inches, is taken as the *unit of length* (metre); of the metre one-tenth, 3.93 inches, is taken, and upon it a cube constructed, which contains of distilled water 1,000 Cc. or Gm., and this furnishes the *unit of capacity* (litre); again, of the metre the one-hundredth part, .393 of an inch, is taken, and upon it a cube constructed, which contains of distilled water 1 Cc., weighing 15.434 grains, and this furnishes the *unit of weight* (gramme).

Milli-metre, mm.,	-litre, ml.,	-gramme, mg. =	.001
(Cubic centimetre, Cc.)			
Centi-metre, cm.,	-litre, cl.,	-gramme, cg. =	.01
Deci-metre, dm.,	-litre, dl.,	-gramme, dg. =	.1
METRE, M.,	LITRE, L.,	GRAMME, Gm. =	1.
Deka-metre, Dm.,	-litre, Dl.,	-gramme, Dg. =	10.
Hecto-metre, Hm.,	-litre, Hl.,	-gramme, Hg. =	100.
Kilo-metre, Km.,	-litre, Kl.,	-gramme, Kg. =	1,000.
Myria-metre, Mm.,	-litre, Ml.,	-gramme, Mg. =	10,000.

Here every unit is multiplied or divided by 10, consequently each preceding denomination is just 10 times smaller than the one that follows, thus it takes 10 millimetres to make 1 centimetre, 10 centimetres to make 1 decimetre, etc.

4. *Prescription*.—This consists of four parts: 1. *Superscription* (date, name and address of patient; also regular sign, *R*, fr. *L. recipio*, *recipere*, to take; *recipe*, take thou); 2. *Inscription* (the body, consisting of

*basis* or chief ingredient, *adjuvant* or assistant to basis, *corrective* or anything to correct the injurious quality of the two preceding, *vehicle* or *excipient* to make it pleasant and of suitable form; 3. Subscription (directions to the compounder, usually in Latin); 4. Signature (directions for taking, also physician's name, in English).

A prescription may consist of a single article, the base, and although the fewer the drugs combined often the better, yet sometimes much good results from mixing several, as in the case of cathartics, of which different ones act upon various portions of the canal. Every article should be written in the Latin genitive, and if of several parts each should receive this ending. It is, however, very seldom that the physician adheres absolutely to this rule, as he so often omits terminations and otherwise abbreviates, a habit that frequently gives ambiguity and sometimes annoyance to the compounder.

Words having nominative ending in *a*, have genitive in *æ*; those in *us*, *um*, *os*, *on* = *i*; *as* = *atis*; *is* = *idis*, *eris*, *itis*; *o* = *onis*, *inis*, etc. The quantities are governed by the verb *recipio*, hence are in the objective case, and when expressed in Latin nomenclature, which is very rare, should be placed in the accusative. The English of the average prescription has about this form: Take thou (imp.) of drugs (gen.) certain quantities (acc.), mix thou (imp.), let (thou) a solution, mixture, pills, etc. (nom. s. or pl.), be made (sub. used as passive imp.).

Superscription.	{	R	For MR. BONAPARTE, 1241 ST. PAUL ST., Dec. 1, 1902.
Inscription.	{	(Basis.) Morphine Sulphatis,	gr. iv 0.26 (gm.
		(Adjuvant.) Sodii Bromidi	ʒij 8. (gm.
		(Corrective.) Syrupi Aurantii,	ʒj 30. (cc.
		(Vehicle.) Aquæ Cinnamomi, q. s.	(ad) ʒiv 120. (cc.
Subscription.		M., ft. mist. (sol.).	
Signature.	{	S. (Sig.) Teaspoonful every 3 hours.	

DR. MITCHELL.

5. *Abbreviations*.—Only such as are in common use, along with accustomed signs should be employed, as: ʒ, ʒ, ʒ, ℥, M, O, S, ℥, ad, gr., gtt., ft., lb., et, ss, q. s., sig., cong., misce, mist., cap., chart., emul., pil., solv., sol., pulv., etc. The following should always be avoided: aconit. (for aconitine, aconitum), ammon. (ammonia, ammoniacum), aq. chlor. (aqua chlori, aqua chloroformi), chlor. (chlorine, chloral, chloroform), hyd. chlor. (calomel, corrosive sublimate, hydrated chloral), sod. sulph. (sodium sulphite, sulphide, sulphate), zinc. phos. (zinc phosphate, zinc phosphide), ac. hydroc. (acid hydrochloric, acid hydrocyanic diluted), ext. col. (extract colchicum, extract colocynth), sod. hypo. (sodium hyposulphite or hypophosphite), aq. fortis (for aqua fortis), etc.

6. *Essentials*.—After having made the diagnosis, then carefully consider the medicines most desirable, their demanded quantities and number of doses, trying never to prescribe more than necessary. See that the doses are neither too large nor follow each other so often as to endanger life—smaller and oft-repeated ones always being advisable. Avoid combining in one prescription medicines that will form poison-

ous compounds, have physiological incompatibilities, or will favor chemical decomposition. Let prescriptions be as simple as possible, having the smallest number of ingredients that will secure the desired effect. Always read them over carefully before finally handing same to attendant, and rewrite rather than permit a visible correction to exist. Large doses should always be underscored with a heavy line by the physician, and when desiring certain prescriptions not to be repeated, he should so mark the blank with the two words *non-repetatur*. When incompatibilities are intentional they should be so indicated by a marginal note; when otherwise the pharmacist will consider it his duty and privilege to make the necessary correction or remedy.

TABLE OF COMPARISON BETWEEN METRIC, AVOIRDUPOIS, AND APOTHECARIES' WEIGHTS.

Names.		Numerical Expressions.	Equivalents in Grains.	Equivalents in Avoirdupois Weight.		Equivalents in Apothecaries' Weight.	
		Gm.	Gr.	lb. oz.	gr.	$\frac{3}{4}$ 3	gr.
Milligramme,	Mg. (mg.)	0.001	0.01543	0 0	$\frac{1}{64}$	0 0	$\frac{1}{64}$
Centigramme,	Cg. (cg.)	0.01	0.15432	0 0	$\frac{1}{8}$	0 0	$\frac{1}{8}$
Decigramme,	Dg. (dg.)	0.1	1.54323	0 0	1.5	0 0	1.5
Gramme,	Gm. (gm.)	1.0	15.43235	0 0	15.4	0 0	15.4
Dekagramme,	Dg.	10.0	154.32356	0 $\frac{1}{4}$	45.0	0 2	34.0
Hectogramme,	Hg.	100.0	1543.23563	0 3 $\frac{1}{2}$	12.0	3 1	43.0
Kilogramme,	Kg.	1000.0	15432.35639	2 3 $\frac{1}{2}$	10.47	32 1	12.4
Myriagramme,	Mg.	10000.0	154323.56390	22 $\frac{1}{2}$	14.8	321 4	3.5

In writing prescriptions physicians usually consider 1 Gm. as being 15 gr., 4 Cc. as 1 fluidrachm, 30 Cc. as 1 fluidounce.

TABLE OF COMPARISON BETWEEN METRIC AND APOTHECARIES' FLUID MEASURE.

Cubic Centimetre.	Minims.	$\frac{f}{3}$	$\frac{f}{3}$	$\mathfrak{m}$
0.06163	1.0			
0.30815	5.0			
0.61630	10.0			
1.0	16.23			
5.0	81.15		1	21.15
10.0	162.30		2	42.3
20.0	324.60		5	24.6
30.0	486.90	1	0	6.9
40.0	649.20	1	2	49.2
50.0	811.50	1	5	31.5
60.0	973.80	2	0	13.8
70.0	1136.10	2	2	56.1
80.0	1298.40	2	5	38.4
90.0	1460.70	3	0	20.7
100.0	1623.00	3	3	3.0
250.0	4057.50	8	3	37.5
500.0	8115.00	16	7	15.0
1000.0	16230.00	33	6	30.0

## CORRESPONDING VALUES WHICH SHOULD BE MEMORIZED BY EVERYONE.

1 millimetre, Mm. (mm.) =  $\frac{1}{8}$  of an inch. 1 centimetre, Cm. (cm.) =  $\frac{1}{2}$  of an inch.  
 1 inch = 25 millimetres or  $2\frac{1}{2}$  centimetres.  
 1 cubic centimetre, Cc. (cc.) = 16.23 minims. 1 fluidounce = 29.53 Cc. (cc.).  
 1 gramme, Gm. (gm.) = 15.4324 grains. 1 grain = 0.0648 gramme.  
 1 milligramme, Mg. (mg.) = 0.01543 =  $\frac{1}{64}$  grain. 1 litre, L. = 34 fluidounces =  $2\frac{1}{2}$  pints.

*Rule.*—To convert grains (whole) into metric, multiply the metric equivalent of 1 grain—0.0648, by the number of grains in question, say 30, thus  $0.0648 \times 30 = 1.944$  Gm.; for fractions of grains divide the denominator of the fraction into 0.0648, and multiply quotient by numerator—say  $\frac{1}{64}$ , thus  $0.0648 \div 64 = 0.001 \times 1 = 0.001$  Gm.

#### MEASURES OF APPROXIMATION.

While these equivalents are not precisely accurate, their values have so long been recognized by laymen on the one hand, and physicians on the other, that they will possibly always be thus accepted :

A drop .....	℥j.....	.06	Cc.
A teaspoonful.....	℥j.....	4	Cc.
A dessertspoonful .....	℥ij.....	8	Cc.
A tablespoonful .....	℥iv.....	15	Cc.
A wineglassful.....	℥ij.....	60	Cc.
A teacupful .....	℥iv.....	120	Cc.
A tumblerful.....	℥viii-xj.....	240-325	Cc.
A breakfastcupful.....	℥vij.....	240	Cc.

Another likely source of error in weights and measures arises from quantities purchased in original containers from the manufacturers. Thus we speak of drachm vials of morphine sulphate, which in point of fact contain only one-eighth of 437.5 grs.—indeed, all solids when thus purchased have per ounce only the 437.5 grs., yet per pound sixteen times this amount, or 7,000 grs. With liquids the result is often much more misleading, especially of those having low or high specific gravities. These are sold mostly originally by weight, which causes the bulk often to be at variance with what some might expect.

1 lb...473 Gm. Sulphuric Acid .....	℥38½.....	250	Cc.
1 lb...473 Gm. Liquor Ferri Subsulphatis.....	℥310.....	296	Cc.
1 lb...473 Gm. Chloroform .....	℥104.....	305	Cc.
1 lb...473 Gm. Syrup Simple.....	℥11½.....	350	Cc.
1 lb...473 Gm. Glycerin.....	℥12½.....	360	Cc.
1 lb...473 Gm. Liquor Plumbi Subacetatis.....	℥12½.....	380	Cc.
1 lb...473 Gm. Aqua Ammoniae (10 p. c.).....	℥16.....	473	Cc.
1 lb...473 Gm. " " (28 p. c.).....	℥17.....	503	Cc.
1 lb...473 Gm. Spiritus Ætheris Nitrosi.....	℥18½.....	540	Cc.
1 lb...473 Gm. Essential Oil.....	℥13-18.....	385-532	Cc.
1 lb...473 Gm. Æther.....	℥21½.....	625	Cc.

TABLE GIVING THE MAXIMUM QUANTITIES THAT SHOULD BE PRESCRIBED UNLESS SPECIAL DIRECTIONS ACCOMPANY THE PRESCRIPTION.

	Single doses.			Total amount in any one day.	
Acid Arsenous.....	gr. ½	.01	Gm.	gr. ½	.03 Gm.
Acid Hydrocyanic Diluted.....	℥x	.6	Cc.	℥xxx 2	Cc.
Acid Nitromuriatic.....	℥v	.3	Cc.	℥xxx 2	Cc.
Aconite Leaf, Extract of.....	gr. 1½	.1	Gm.	gr. 10	.6 Gm.
Aconite Root, Fluidextract of.....	℥v	.3	Cc.	℥xv	1 Cc.
Aconite Root, Tincture of.....	℥vj	.4	Cc.	℥xv	1 Cc.
Aconite Root, Fleming's Tincture of.....	℥ij	.2	Cc.	℥x	.6 Cc.
Aconitine and its salts.....	gr. ⅙	.0013	Gm.	gr. ⅙	.006 Gm.
Arsenic Chloride, Solution of.....	℥vj	.4	Cc.	℥xv	1 Cc.
Arsenic Iodide.....	gr. ½	.01	Gm.	gr. ½	.03 Gm.
Arsenic and Mercury, Solution of					
Iodides of.....	℥xx	1.3	Cc.	℥lx	4 Cc.
Arsenite of Potassium, Solution of.....	℥xv	1	Cc.	℥xliv	3 Cc.

Single doses.			Total amount in any one day.	
Atropine and its salts.....	gr. $\frac{1}{60}$	.001 Gm.	gr. $\frac{1}{60}$	.003 Gm.
Belladonna. Extract of.....	gr. 1	.06 Gm.	gr. 5	.3 Gm.
Codeine.....	gr. 2	.13 Gm.	gr. 5	.3 Gm.
Coniine.....	gr. $\frac{1}{15}$	.004 Cc.	gr. $\frac{1}{4}$	.03 Cc.
Conium, Extract of.....	gr. 2	.13 Gm.	gr. 8	.5 Gm.
Croton Oil.....	℥ij	.13 Cc.		
Digitalin.....	gr. $\frac{1}{60}$	.0013 Gm.	gr. $\frac{1}{60}$	.003 Gm.
Digitalis, Extract of.....	gr. $\frac{1}{2}$	.03 Gm.	gr. 1	.06 Gm.
Hyoscyamus, Extract of.....	gr. 3	.2 Gm.	gr. 10	.6 Gm.
Ignatia, Extract of.....	gr. 3	.2 Gm.	gr. 10	.6 Gm.
Cannabis Indica, Extract of.....	gr. 1	.06 Gm.	gr. 5	.3 Gm.
Corrosive Sublimate.....	gr. $\frac{1}{4}$	.016 Gm.	gr. $\frac{1}{4}$	.05 Gm.
Mercuric Iodide, Red.....	gr. $\frac{1}{4}$	.016 Gm.	gr. 1	.06 Gm.
Mercurous Iodide, Yellow.....	gr. 1	.06 Gm.	gr. 3	.2 Gm.
Morphine and its salts.....	gr. $\frac{1}{4}$	.03 Gm.	gr. 2	.13 Gm.
Nux Vomica, Extract of.....	gr. 2	.13 Gm.	gr. 8	.5 Gm.
Opium.....	gr. 2	.13 Gm.	gr. 10	.6 Gm.
Opium, Extract of.....	gr. 1	.06 Gm.	gr. 4	.26 Gm.
Opium, Tincture of.....	℥xxx 2	Cc.	℥cxxx 8	Cc.
Phosphorus.....	gr. $\frac{1}{6}$	.013 Gm.	gr. $\frac{1}{6}$	.03 Gm.
Physostigma, Extract of.....	gr. $\frac{1}{4}$	.016 Gm.	gr. 1	.06 Gm.
Potassium Cyanide.....	gr. $\frac{1}{4}$	.016 Gm.	gr. 1	.06 Gm.
Sodium Arsenate.....	gr. $\frac{1}{8}$	.02 Gm.	gr. 1	.06 Gm.
Stramonium Leaves, Extract of.....	gr. 2	.13 Gm.	gr. 5	.3 Gm.
Stramonium Seed, Extract of.....	gr. 1	.06 Gm.	gr. 3	.2 Gm.
Strychnine and its salts.....	gr. $\frac{1}{12}$	.005 Gm.	gt. $\frac{1}{4}$	.016 Gm.
Tartar Emetic.....	gr. 2	.13 Gm.		
Veratrum, Fluidextract of.....	℥ijj	.2 Cc.	℥x	.6 Cc.
Veratrum, Tincture of.....	℥v	.3 Cc.	℥xij	.8 Cc.

DOSES OF RARE AND UNOFFICIAL DRUGS, SOME NOT TREATED OF  
IN THIS WORK.

Abrastol, gr. 15-20.....	1-2 Gm.	Antikamnia, gr. 5-10.....	3-6 Gm.
Acetal, ℥j-2.....	4-8 Cc.	Antinervin, gr. 5-8.....	3-5 Gm.
Acet-ortho-toluide, gr. 2-5.....	.13-.3 Gm.	Antirheumatin, gr. 1-1 $\frac{1}{2}$ .....	.06-.1 Gm.
Acet-para-toluide, gr. 15-30.....	1-2 Gm.	Antispasmin, gr. $\frac{1}{4}$ -1 $\frac{1}{2}$ .....	.01-.1 Gm.
Acetyl-amido antipyrine, gr. 10-30.....	.6-2 Gm.	Antitetraizin, gr. 3-4.....	.2-.26 Gm.
Acid anticylic, gr. $\frac{1}{16}$ .....	.0006 Gm.	Antithermin, gr. 3.....	.2 Gm.
Acid cathartine, gr. 3-6.....	.2-.4 Gm.	Antitoxin, ℥j-2.....	4-8 Cc.
Acid cubebic, gr. 5-10.....	.3-.6 Gm.	Apocodeine hydrochloride, gr. 1-1 $\frac{1}{2}$ .....	.06-.09 Gm.
Acid fluoric dil., ℥x-20.....	.6-1.3 Cc.	Aralia hispida, gr. 20-40.....	1.3-2.6 Gm.
Acid hydriodic dil., ℥j.....	.4 Cc.	Aralia racemosa, gr. 20-40.....	1.3-2.6 Gm.
Acid hydrocinnamic, gr. 1-2.....	.06-.13 Gm.	Arbutin, gr. 3-5.....	.2-.3 Gm.
Acid ortho-amido salicylic, gr. 2-5.....	.13-.3 Gm.	Arecoline, gr. $\frac{1}{20}$ - $\frac{1}{12}$ .....	.003-.004 Gm.
Acid osmic, gr. $\frac{1}{8}$ .....	.001 Gm.	Asparagin, gr. $\frac{1}{2}$ -1 $\frac{1}{2}$ .....	.03-.1 Gm.
Acid picric, gr. 1-5.....	.06-.3 Gm.	Aspidospermine, gr. 1-2.....	.06-.13 Gm.
Acid polygalic, gr. $\frac{1}{4}$ -1.....	.016-.06 Gm.	Benzacetone, gr. 5-15.....	.3-1 Gm.
Adonin (adonidin), gr. $\frac{1}{8}$ - $\frac{1}{4}$ .....	.004-.02 Gm.	Benzosol, gr. 4-8.....	.26-.5 Gm.
Agaricin, gr. $\frac{1}{2}$ -2.....	.03-.13 Gm.	Berberine, gr. $\frac{1}{4}$ -1.....	.03-.06 Gm.
Agathin, gr. 5-10.....	.3-.6 Gm.	Betol, gr. 5-8.....	.3-.5 Gm.
Alantol, gr. $\frac{1}{4}$ .....	.01 Gm.	Bismuth albuminate, gr. 8-15.....	.5-1 Gm.
Ammonium embellicum, gr. 2-6.....	.13-.4 Gm.	Bismuth benzoate, gr. 5-10.....	.3-.6 Gm.
Ammonium picrate, gr. $\frac{1}{4}$ - $\frac{1}{2}$ .....	.016-.03 Gm.	Bismuth cerium salicylate, gr. 15-30.....	1-2 Gm.
Ammonium salicylate, gr. 5-20.....	.3-1.3 Gm.	Bismuth naphtholate, gr. 15-30.....	1-2 Gm.
Ammonol, gr. 5-20.....	.3-1.3 Gm.	Bismuth salicylate, gr. 5-30.....	.3-2 Gm.
Amyl valerate (valerianate), gr. 2-3.....	.13-.2 Gm.	Bismuth sulphite, gr. 5-15.....	.3-1 Gm.
Amylum iodatum, gr. 5-30.....	.3-2 Gm.	Bismuth valerate (valerianate), gr. 1-3.....	.06-.2 Gm.
		Boldin, gr. 1.....	.06 Gm.
		Boldoa fragrans, gr. 15-30.....	1-2 Gm.
		Bromal hydrate, gr. 1-15.....	.06-1 Gm.
		Bromalin, gr. 30-60.....	2-4 Gm.



Bromamide, gr. 5-10.....	3-6 Gm.	Iron magnetic oxide, gr. 5-10...	3-6 Gm.
Buxine, gr. 15-30 .....	1-2 Gm.	Iron malate, gr. 5-15.....	3-1 Gm.
Cactus grandiflorus, gr. 5-10.....	3-6 Gm.	Iron pomate, gr. 5-15.....	3-1 Gm.
Cæsium bitartrate, gr. 2-5 .....	13-3 Gm.	Kairin, gr. 2-10 .....	13-6 Gm.
Caffeine chloral, gr. 3-5 .....	2-3 Gm.	Kava-kava, gr. 10-30 .....	6-2 Gm.
Caffeine tri-iodide, gr. 2-4.....	13-26 Gm.	Kosin, gr. 5-30 .....	3-2 Gm.
Calcium benzoate, gr. 10.....	6 Gm.	Lactol, gr. 3-8.....	2-5 Gm.
Calcium borate, gr. 3-6.....	2-4 Gm.	Lantanine, gr. 15-30 .....	1-2 Gm.
Calcium salicylate, gr. 8-24 ...	5-1.5 Gm.	Liparin, $\mathfrak{zj}$ -4 .....	4-15 Cc.
Camphor salicylate, gr. 1-4....	.06-.26 Gm.	Lithium benzoate, gr. 5-15 .....	3-1 Gm.
Cannabinon, gr. $\frac{1}{2}$ -1 $\frac{1}{2}$ .....	.03-.1 Gm.	Lithium formate, gr. 3 .....	.2 Gm.
Carniferrin, gr. 3-5 .....	2-3 Gm.	Lithium salicylate, gr. 10-30.....	6-2 Gm.
Carpine, gr. $\frac{1}{10}$ - $\frac{1}{4}$ ...	.006-.01 Gm.	Lithium sulphoichthyolate, gr. 5-8.	
Cerium nitrate, gr. 1-2.....	.06-.13 Gm.		3-.5 Gm.
Cetrarin, gr. 1-3 .....	.06-.2 Gm.	Lysidine, gr. 15-60.....	1-4 Gm.
Chionanthus virginica, $\mathfrak{zss}$ -1.....	2-4 Gm.	Magnesium lactate, gr. 15-45 ....	1-3 Gm.
Chinoline salicylate, gr. 5-15 ...	3-1 Gm.	Magnesium phenolsulphonate, gr. 15-30.	
Chinoline tartrate, gr. 5-15 .....	3-1 Gm.		1-2 Gm.
Chloral ammonium, gr. 15-30.....	1-2 Gm.	Magnesium salicylate, gr. 15-30..	1-2 Gm.
Chlorphenol, $\mathfrak{M}$ xv-30 .....	1-2 Cc.	Malakin, gr. 10-15.....	6-1 Gm.
Cocaine borate, gr. $\frac{1}{2}$ -2 .....	.008-.13 Gm.	Malt extract, $\mathfrak{zj}$ -2.....	4-8 Cc.
Cocaine lactate, gr. $\frac{1}{2}$ -2 .....	.008-.13 Gm.	Mercuric naphtholate, gr. 1 .....	.06 Gm.
Cocaine nitrate, gr. $\frac{1}{2}$ -2 .....	.008-.13 Gm.	Mercuric peptonate, gr. $\frac{1}{2}$ .....	.01 Gm.
Cocaine saccharate, gr. $\frac{1}{2}$ -2....	.008-.13 Gm.	Mercuric salicylate, gr. $\frac{1}{2}$ -1.	
Codeine phosphate, gr. $\frac{1}{2}$ -2....	.03-.13 Gm.		.001-.008 Gm.
Convolvulin, gr. 1-2 .....	.06-.13 Gm.	Mercuric thymol-acetate, gr. $\frac{1}{2}$ -1.	
Cornutine, gr. $\frac{1}{2}$ -1 .....	.003-.01 Gm.		.005-.01 Gm.
Coronillin, gr. 1-2.....	.06-.13 Gm.	Mercuric thymolate, gr. $\frac{1}{2}$ -1.	
Corydalis, gr. 10-30.....	6-2 Gm.		.005-.01 Gm.
Creosote carbonate, $\mathfrak{M}$ iij-15 .....	2-1 Cc.	Mercurous acetate, gr. $\frac{1}{2}$ -1.....	.01-.06 Gm.
Curare, gr. $\frac{1}{10}$ - $\frac{1}{2}$ .....	.006-.02 Gm.	Mercurous tannate, gr. 1-2.....	.06-.13 Gm.
Curarine, gr. $\frac{1}{4}$ - $\frac{1}{2}$ .....	.001-.002 Gm.	Mercury amido-propionate, gr. $\frac{1}{2}$ -1.	
Cystine, gr. $\frac{1}{2}$ -1 .....	.003-.005 Gm.		.005-.01 Gm.
Cystine nitrate, gr. $\frac{1}{2}$ -1 .....	.003-.005 Gm.	Mercury phenolate, gr. $\frac{1}{2}$ -1....	.016-.03 Gm.
Damiana, gr. 30-120.....	2-8 Gm.	Mercury formamidate (1 p. c. sol.), $\mathfrak{M}$ v-15 .....	3-1 Cc.
Dioscorea, gr. 10-30 .....	6-2 Gm.	Mercury imido-succinate, gr. $\frac{1}{2}$ -1.	
Dita bark, gr. $\frac{1}{2}$ -3 .....	.03-.2 Gm.		.005-.01 Gm.
Drosera, gr. 5-10 .....	3-6 Gm.	Mercury sozo-iodolate, gr. 1 .....	.06 Gm.
Erythrophloeine, gr. $\frac{1}{2}$ -1 .....	.002-.004 Gm.	Methylene blue, gr. 2-8 .....	13-5 Gm.
Ethoxy caffeine, gr. 3 .....	.2 Gm.	Methoxy caffeine, gr. 2-4.....	13-26 Gm.
Eucalyptol, gr. 10-20 .....	6-1.3 Gm.	Migranin, gr. 10-15 .....	6-1 Gm.
Euphorbia pilulifera, gr. 30-60 ...	2-4 Gm.	Morphine benzoate, gr. $\frac{1}{2}$ -1.	
Ferratin, gr. 3-8 .....	2-5 Gm.		.01-.016 Gm.
Ferropyrine, gr. 5-15.....	3-1 Gm.	Morrhual, gr. 1-5 .....	.06-.3 Gm.
Fuchsine, gr. $\frac{1}{4}$ -4.....	.03-.26 Gm.	Myrtol, $\mathfrak{M}$ v .....	3 Cc.
Gallo-bromol, gr. 15-120 .....	1-8 Gm.	Naphtol, gr. 5-15.....	3-1 Gm.
Gold bromide, $\frac{1}{10}$ - $\frac{1}{10}$ .....	.003-.006 Gm.	Narceine hydrochloride, gr. $\frac{1}{2}$ -1.	
Gold chloride, $\frac{1}{10}$ - $\frac{1}{10}$ .....	.003-.006 Gm.		.01-.06 Gm.
Gold monocyanide, $\frac{1}{10}$ - $\frac{1}{4}$ ....	.003-.016 Gm.	Narcotine, gr. 3-10 .....	2-6 Gm.
Gold tricyanide, $\frac{1}{10}$ - $\frac{1}{4}$ .....	.003-.016 Gm.	Neurodine, gr. 10-20 .....	6-1.3 Gm.
Gurjun balsam, $\mathfrak{zss}$ -2 .....	2-8 Cc.	Oleo-creosote, $\mathfrak{M}$ v-15 .....	3-1 Cc.
Hæmogallol, gr. 3-5.....	2-3 Gm.	Orexine, gr. 2-6 .....	13-4 Gm.
Hæmol, gr. 1-8 .....	.06-.5 Gm.	Orthine, gr. 3-8.....	2-5 Gm.
Hæmoglobin, gr. 1-3 ...	.06-.2 Gm.	Ouabain, gr. $\frac{1}{10}$ - $\frac{1}{10}$ .....	.00006 Gm.
Helenin, gr. $\frac{1}{2}$ .....	.01 Gm.	Oxy-sparteine, gr. $\frac{1}{2}$ -1 $\frac{1}{2}$ .....	.03-.1 Gm.
Heliotropine, gr. 5-15.....	3-1 Gm.	Papain, gr. 2-5 .....	13-3 Gm.
Homatropine, gr. $\frac{1}{2}$ - $\frac{1}{2}$ ....	.0005-.001 Gm.	Papayotin, gr. 2-5 .....	13-3 Gm.
Homatropine hydrobromide, gr. $\frac{1}{2}$ - $\frac{1}{2}$ ....	.0005-.001 Gm.	Paracressalol, gr. 3-30 .....	2-2 Gm.
Hydracetine, gr. $\frac{1}{2}$ -1 $\frac{1}{2}$ .....	.03-.1 Gm.	Phenidin, gr. 5-15 .....	3-1 Gm.
Hydrangea, gr. 30-60.....	2-4 Gm.	Phenyl ester of anisic acid, gr. 5-15.	
Hydronaphtol, gr. 1-2.....	.06-.13 Gm.		5-1 Gm.
Iodo-caffeine, gr. 5 .....	.3 Gm.	Phloridzin, gr. 5-10 .....	3-6 Gm.
Iridin (irisin), gr. 1-4 .....	.06-.26 Gm.	Phytolaccin, gr. 2-3 .....	13-2 Gm.
Iron benzoate, gr. 1-5 .....	.06-.3 Gm.	Piliganine hydrochloride, gr. $\frac{1}{2}$ -1.	
Iron dialyzed, $\mathfrak{M}$ v-30.....	3-2 Cc.		.01-.02 Gm.

Potassium cobalto-nitrite, gr. $\frac{1}{2}$ .....	.03 Gm.	Sodium para-cresotate, gr. 30-90.	2-6 Gm.
Potassium osmate, gr. $\frac{1}{2}$ .....	.001 Gm.	Sodium sulfo-cafeate, gr. 15 .....	1 Gm.
Propylamine, gr. 30-60 .....	2-4 Gm.	Solanine, gr. $\frac{1}{2}$ -1.....	.01-.06 Gm.
Pyoktanin, gr. 1-5 .....	.06-.3 Gm.	Somatose, 3ss-8 .....	2-30 Gm.
Pyrazol, gr. 15-30 .....	1-2 Gm.	Sulphaminol, gr. 2-4 .....	.13-.26 Gm.
Pyridine, Mj-3.....	.06-.2 Cc.	Tartar-lithine, gr. 5-10.....	.3-.6 Gm.
Quinine arsenite, gr. $\frac{1}{2}$ - $\frac{1}{2}$ ... ..	.005-.03 Gm.	Tartar-lithine and sulphur, gr. 5-10.	
Quinine salicylate, gr. 1-8.....	.06-.5 Gm.		.3-.6 Gm.
Quinine tannate, gr. 3-8 .....	.2-.5 Gm.	Terpinol, gr. 5-15 .....	.3-1 Gm.
Retinol, gr. 1.....	.06 Gm.	Thalline tartrate, gr. 2-8.....	.13-.5 Gm.
Rubidium ammonium bromide, gr. 15-20.		Thermifugin, gr. 1-4 .....	.06-.26 Gm.
	1-1.3 Gm.	Thermodin, gr. 5-15 .....	.3-1 Gm.
Rubidium iodide, gr. 1-2.....	.06-.13 Gm.	Thiol, gr. 2-10.....	.13-.6 Gm.
Salicylamide, gr. 2-5 .....	.13-.3 Gm.	Thymacetin, gr. 3-10 .....	.2-.6 Gm.
Santoninoxime, gr. 1-2.....	.06-.13 Gm.	Tolypyrine, gr. 8-30 .....	.5-2 Gm.
Scillain, gr. $\frac{1}{2}$ - $\frac{1}{2}$ .....	.01-.05 Gm.	Tolysal, gr. 15-30 .....	1-2 Gm.
Scillipicin, gr. $\frac{1}{6}$ .....	.001 Gm.	Tussol, gr. 2-8 .....	.13-.5 Gm.
Sodium anisate, gr. 10-15.....	.6-1 Gm.	Uropherin, gr. 10-15.....	.6-1 Gm.
Sodium di-thio-salicylate, gr. 3.....	.2 Gm.	Vieirin, gr. 1-3 .....	.06-.2 Gm.

TABLE SHOWING THE NUMBER OF DROPS IN A FLUIDRACHM OF VARIOUS LIQUIDS,  
WITH THE WEIGHT OF ONE FLUIDRACHM OF EACH IN GRAINS AND IN GRAMMES.

	Drops in f℥j. (60 m.)	Weight of f℥j in	
		grains.	grammes.
Acetum opii . . . . .	90	61	3.95
Acetum sanguinarie . . . . .	78	55 $\frac{1}{2}$	3.59
Acetum scillæ . . . . .	68	57	3.69
Acidum aceticum . . . . .	108	58	3.75
Acidum aceticum dilutum . . . . .	68	55	3.56
Acidum hydrochloricum . . . . .	70	65	4.21
Acidum hydrochloricum dilutum . . . . .	60	56	3.62
Acidum hydrocyanicum dilutum . . . . .	45	54	3.49
Acidum lacticum . . . . .	111	66	4.27
Acidum nitricum . . . . .	102	77	4.98
Acidum nitricum dilutum . . . . .	60	58	3.62
Acidum nitrohydrochloricum . . . . .	76	66	4.27
Acidum phosphoricum dilutum . . . . .	59	57	3.69
Acidum sulphuricum . . . . .	128	101	6.54
Acidum sulphuricum aromaticum . . . . .	146	53	3.43
Acidum sulphuricum dilutum . . . . .	60	58 $\frac{1}{2}$	3.79
Acidum sulphurosum . . . . .	59	55	3.56
Æther fortior . . . . .	176	39	2.52
Alcohol . . . . .	146	44	2.85
Alcohol dilutum . . . . .	137	49	3.17
Aqua . . . . .	60	55	3.56
Aqua ammoniæ fortior . . . . .	66	50	3.24
Balsamum peruvianum . . . . .	101	60	3.88
Bromum . . . . .	250	165	10.69
Chloroformum purificatum . . . . .	250	80	5.18
Copaiba . . . . .	110	51	3.30
Creosote . . . . .	122	56 $\frac{1}{2}$	3.66
Fluidextractum belladonnæ . . . . .	156	57	3.69
Fluidextractum buchu . . . . .	150	47 $\frac{1}{2}$	3.07
Fluidextractum cinchonæ . . . . .	138	58	3.75
Fluidextractum colchici radiciæ . . . . .	160	57	3.69
Fluidextractum colchici seminis . . . . .	158	55	3.56
Fluidextractum conii fructus . . . . .	137	61	3.93
Fluidextractum digitalis . . . . .	134	62	4.01
Fluidextractum ergotæ . . . . .	133	60	3.88
Fluidextractum gelsemii . . . . .	149	49	3.14
Fluidextractum glycyrrhizæ . . . . .	133	61	3.95
Fluidextractum hyoscyami . . . . .	160	59	3.82

	Drops in f3j. (60 m.)	Weight of f3j in	
		grains.	grammes.
Fluidextractum ipecacuanhæ . . . . .	120	60	3.88
Fluidextractum pareiræ . . . . .	140	57	3.72
Fluidextractum rhei . . . . .	158	61	3.95
Fluidextractum sarsaparillæ compositum . . . . .	134	60	3.88
Fluidextractum senegæ . . . . .	137	62	4.01
Fluidextractum serpentariæ . . . . .	148	47	3.07
Fluidextractum uvæ-ursi . . . . .	137	60	3.88
Fluidextractum valerianæ . . . . .	150	49	3.17
Fluidextractum veratri . . . . .	150	50	3.24
Fluidextractum zingiberis . . . . .	142	48	3.11
Glycerinum . . . . .	67	68	4.40
Hydrargyrum . . . . .	150	760	49.24
Liquor acidi arsenosi . . . . .	57	55	3.56
Liquor ammonii acetatis . . . . .	75	56	3.62
Liquor arseni et hydrargyri iodidi . . . . .	58	55	3.56
Liquor ferri chloridi . . . . .	71	72	4.66
Liquor ferri citratis . . . . .	71	72	4.66
Liquor ferri nitratis . . . . .	59	59	3.82
Liquor ferri subsulphatis . . . . .	73	83	5.37
Liquor ferri tersulphatis . . . . .	83	72	4.66
Liquor hydrargyri nitratis . . . . .	131	123	7.97
Liquor iodi compositus . . . . .	63	59	3.82
Liquor plumbi subacetatis . . . . .	74	70	4.53
Liquor potassii hydroxidi . . . . .	62	58	3.75
Liquor potassii arsenitis . . . . .	57	55	3.56
Liquor sodæ chlorinatæ . . . . .	63	62	4.01
Liquor zinci chloridi . . . . .	89	88	5.70
Oleoresina aspidii . . . . .	130	52	3.36
Oleoresina capsici . . . . .	120	51	3.30
Oleoresina cubebæ . . . . .	123	52	3.36
Oleum æthereum . . . . .	125	50	3.24
Oleum amygdalæ amaræ . . . . .	115	55	3.56
Oleum amygdalæ expressum . . . . .	108	48½	3.14
Oleum anisi . . . . .	119	54	3.49
Oleum aurantii corticis . . . . .	120	54	3.49
Oleum bergamottæ . . . . .	130	46	2.98
Oleum cari . . . . .	132	50	3.24
Oleum caryophylli . . . . .	130	57	3.69
Oleum chenopodii . . . . .	97	50	3.24
Oleum cinnamomi . . . . .	126	53½	3.46
Oleum copaibæ . . . . .	123	49½	3.20
Oleum cubebæ . . . . .	125	51	3.30
Oleum fœniculi . . . . .	125	53	3.43
Oleum gaultheriæ . . . . .	125	62	4.01
Oleum juniperi . . . . .	148	49	3.17
Oleum lavandulæ florum . . . . .	138	52	3.36
Oleum limonis . . . . .	129	47	3.04
Oleum menthæ piperitæ . . . . .	129	50	3.24
Oleum olivæ . . . . .	76	51	3.33
Oleum ricini . . . . .	77	51½	3.33
Oleum rosæ . . . . .	132	47	3.04
Oleum rosmarini . . . . .	143	50	3.24
Oleum sabinæ . . . . .	102	54	3.49
Oleum sassafras . . . . .	133	58	3.75
Oleum terebinthinæ . . . . .	136	45½	2.94
Oleum tigllii . . . . .	104	50	3.24
Phenol (acidum carbolicum) . . . . .	111	59	3.82
Spiritus ætheris compositus . . . . .	148	45	2.91
Spiritus ætheris nitrosi . . . . .	146	47	3.04
Spiritus ammoniæ aromaticus . . . . .	142	48	3.11
Spiritus camphoræ . . . . .	143	47	3.04
Spiritus chloroformi . . . . .	150	48	3.11
Spiritus menthæ piperitæ . . . . .	142	47	3.04

	Drops in f3j. (60 m.)	Weight of f3j in	
		grains.	grammes
Syrupus acaciæ . . . . .	44	73	4.73
Syrupus ferri iodidi . . . . .	65	77	4.98
Syrupus scillæ . . . . .	75	74	4.79
Syrupus scillæ compositus . . . . .	102	70	4.53
Syrupus senegæ . . . . .	106	70	4.53
Syrupus simplex . . . . .	65	72	4.66
Tinctura aconiti . . . . .	146	46	2.98
Tinctura asafetidæ . . . . .	120	54	3.49
Tinctura belladonnæ foliorum . . . . .	137	53	3.43
Tinctura benzoini composita . . . . .	148	48	3.11
Tinctura cantharidis . . . . .	131	51	3.33
Tinctura cinchonæ composita . . . . .	140	49	3.17
Tinctura digitalis . . . . .	128	53	3.43
Tinctura ferri chloridi . . . . .	150	53	3.43
Tinctura guaiaci . . . . .	130	46	2.98
Tinctura iodi . . . . .	148	47	3.04
Tinctura nucis vomicæ . . . . .	140	44	2.85
Tinctura opii . . . . .	130	53	3.43
Tinctura opii camphorata . . . . .	130	52	3.36
Tinctura opii deodorata . . . . .	110	54	3.49
Tinctura tolutana . . . . .	130	46	2.98
Tinctura valerianæ . . . . .	130	52	2.36
Tinctura veratri . . . . .	145	46	2.98
Tinctura zingiberis . . . . .	144	46	2.98
Vinum antimonii . . . . .	72	50	3.24
Vinum colchici radices . . . . .	107	55	3.56
Vinum colchici seminis . . . . .	111	54	3.49
Vinum opii . . . . .	100	55	3.56

TABLE OF THERMOMETRIC EQUIVALENTS.

(Fahrenheit and Centigrade Scales.)

F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.
212 = 100	174 = 79	136 = 58	99 = 37	61 = 16	23 = -5						
210 = 99	172 = 78	135 = 57	97 = 36	59 = 15	21 = -6						
208 = 98	171 = 77	133 = 56	95 = 35	57 = 14	19 = -7						
207 = 97	169 = 76	131 = 55	93 = 34	55 = 13	18 = -8						
205 = 96	167 = 75	129 = 54	91 = 33	54 = 12	16 = -9						
203 = 95	165 = 74	127 = 53	90 = 32	52 = 11	14 = -10						
201 = 94	163 = 73	126 = 52	88 = 31	50 = 10	12 = -11						
199 = 93	162 = 72	124 = 51	86 = 30	48 = 9	10 = -12						
198 = 92	160 = 71	122 = 50	84 = 29	46 = 8	9 = -13						
196 = 91	158 = 70	120 = 49	82 = 28	45 = 7	7 = -14						
194 = 90	156 = 69	118 = 48	81 = 27	43 = 6	5 = -15						
192 = 89	154 = 68	117 = 47	79 = 26	41 = 5	3 = -16						
190 = 88	153 = 67	115 = 46	77 = 25	39 = 4	1 = -17						
189 = 87	151 = 66	113 = 45	75 = 24	37 = 3	-1 = -18						
187 = 86	149 = 65	111 = 44	73 = 23	36 = 2	-2 = -19						
185 = 85	147 = 64	109 = 43	72 = 22	34 = 1	-4 = -20						
183 = 84	145 = 63	108 = 42	70 = 21	32 = 0	-11 = -24						
181 = 83	144 = 62	107 = 41	68 = 20	30 = -1	-31 = -35						
180 = 82	142 = 61	104 = 40	66 = 19	28 = -2	-35 = -37						
178 = 81	140 = 60	102 = 39	64 = 18	27 = -3	-40 = -40						
176 = 80	138 = 59	100 = 38	63 = 17	25 = -4							

To convert Fahrenheit to Centigrade, subtract 32, multiply by 5, and divide by 9.

To convert Centigrade to Fahrenheit, multiply by 9, divide by 5, and add 32.

## POPULAR MEDICAL ABBREVIATIONS.

aa. . . . .	Ana . . . . .	Of each.
Abs. febr. . . . .	Absente febre . . . . .	Fever being absent.
Ad. . . . .	Adde . . . . .	Add up to.
Ad 2 vic. . . . .	Ad duas vices . . . . .	At two doses.
Ad sec. vic. . . . .	Ad secundum vicem . . . . .	For twice.
Ad ter vic. . . . .	Ad tertiam vicem . . . . .	For thrice.
Ad lib. . . . .	Ad libitum . . . . .	At pleasure.
Ad us. . . . .	Ad usum . . . . .	According to custom.
Adst. febre . . . . .	Adstante febre . . . . .	Fever present.
Aeq. . . . .	Equales . . . . .	Equal.
Agit. vas. . . . .	Agitato vase . . . . .	Shaking the vial.
Alt. hor. . . . .	Alternis horis . . . . .	Every other hour.
Aliq. . . . .	Aliquot . . . . .	Some, a few.
Alv. adst. . . . .	Alvo adstricta . . . . .	Bowels confined.
Ampul. . . . .	Ampulla . . . . .	A large bottle.
Aq. . . . .	Aqua . . . . .	Water.
Aq. astr. . . . .	Aqua astricta . . . . .	Frozen water.
Aq. bull. . . . .	Aqua bulliens . . . . .	Boiling water.
Aq. comm. . . . .	Aqua communis . . . . .	Common water.
Aq. ferv. . . . .	Aqua fervens . . . . .	Hot water.
Aq. fluv. . . . .	Aqua fluvialis (fluvialis) . . . . .	River water.
Aq. font. . . . .	Aqua fontalis (fontana) . . . . .	Spring water.
Aq. lac. . . . .	Aqua lacalis . . . . .	Lake water.
Aq. mar. . . . .	Aqua marina . . . . .	Sea water.
Aq. niv. . . . .	Aqua nivalis . . . . .	Snow water.
Aq. pluv. . . . .	Aqua pluvialis (pluvialis) . . . . .	Rain water.
Aut . . . . .	Aut . . . . .	Or.
Bals. . . . .	Balsamum . . . . .	Balsam.
Bib. . . . .	Bibe . . . . .	Drink.
Bid. . . . .	Biduum . . . . .	Two days.
Bis . . . . .	Bis . . . . .	Twice.
Bis in d. . . . .	Bis in die (indies) . . . . .	Twice daily.
Bis in 7 d. . . . .	Bis in septem diebus . . . . .	Twice a week.
Bol. . . . .	Bolus . . . . .	A large pill.
Bull. . . . .	Bulliat (bulliant) . . . . .	Let boil.
But. . . . .	Butyrum . . . . .	Butter.
C. . . . .	Cum . . . . .	With.
C. m. . . . .	Cras mane . . . . .	To-morrow morning.
C. m. a. . . . .	Cras mane sumendus . . . . .	Take to-morrow morning.
C. n. . . . .	Cras nocte . . . . .	To-morrow night.
C. v. . . . .	Cras vespere . . . . .	To-morrow evening.
Cærul. . . . .	Cæruleus . . . . .	Blue.
Cal. . . . .	Calomelas . . . . .	Calomel.
Cap. . . . .	Capiat (Cape) . . . . .	Let him (her) take.
Cap. . . . .	Capsula . . . . .	A capsule.
Caute . . . . .	Caute . . . . .	Cautiously.
Chart. . . . .	Charta . . . . .	Paper.
Chartul. . . . .	Chartula . . . . .	Small paper.
Cib. . . . .	Cibus . . . . .	Food.
Coch. . . . .	Cochleare . . . . .	A spoonful.
Coch. ampl. . . . .	Cochleare amplum . . . . .	A tablespoonful.
Coch. infant. . . . .	Cochleare infantis . . . . .	A teaspoonful.
Coch. mag. . . . .	Cochleare magnum . . . . .	A tablespoonful.
Coch. mod. . . . .	Cochleare modicum . . . . .	A dessertspoonful.
Coch. parv. . . . .	Cochleare parvum . . . . .	A teaspoonful.
Coct. . . . .	Coctio . . . . .	Boiling.
Col. . . . .	Cola . . . . .	Strain.
Colatur. . . . .	Colaturæ . . . . .	To the strained liquor.
Collut. . . . .	Collutorium . . . . .	A mouth wash.
Collyr., coll. . . . .	Collyrium . . . . .	An eye wash.
Comp. . . . .	Compositus . . . . .	Compound, compounded.
Con., concia. . . . .	Concisus . . . . .	Cut.
Conf. . . . .	Confectio . . . . .	Confection.
Contin. . . . .	Continueter . . . . .	Let it be continued.

Cont. rem.	Continuantur remedia	Let medicines be continued.
Coq.	Coque, coquantur	Boil.
Cort.	Cortex	The bark.
Crast., cras.	Crastinus	To-morrow.
Crast.	Crastinus (cras)	Early to-morrow.
Cuj.	Cujus	Of which.
Cyath.	Cyathus	A glassful.
Cyatho theae	Cyatho theae	In a cup of tea.
Cyath. (c.) vinar.	Cyathus vinarius	A wineglassful.
D.	Dosis	A dose.
De d. in d.	De die in diem	From day to day.
D., det.	Da, detur	Give; let it be given.
De.	De	Of or from.
Deaur. pil.	Deaurentur pilulæ	Let the pills be gilded.
Deb. spiss.	Debita spissitudo	A proper consistence.
Dec.	Decanta	Pour off.
Decim.	Decimus	Ten, the tenth.
Decoct.	Decoctum	A decoction.
Deglut.	Deglutiatur	Let it be swallowed.
D. t. d. No. 4.	Dentur tales doses No. 4.	Take 4 such doses.
Dieb. alt.	Diebus alternis	On alternate days.
Dieb. tert.	Diebus tertiis	Every third day.
Dil.	Dilue, dilutus	Dilute, diluted.
Dim.	Dimidius	One-half.
Disp.	Dispensa, dispensetur	Dispense, let it be dispensed.
D. D. or direc. prop.	Directione propria	With proper direction.
D. in p. æq.	Dividatur in partes æquales	Divide in equal parts.
Div., divid.	Dividendus	Divide, to be divided.
Don.	Donec	Until.
Dur. dolor.	Durante dolore	During the pain.
Ead.	Eadem	The same.
Elect.	Electuarium	An electuary.
En., enem.	Enema (enemata)	An enema, a clyster.
Et	Et	And.
Exhib.	Exhibeatur	Let it be exhibited.
Ext.	Extende (extendatur)	Spread.
Extr.	Extractum	An extract.
F., Ft.	Fac, fiat, fiant	Make, let it be made.
F. ft. pil. 12	Fac pilulas duodecim	Make 12 pills.
Far.	Farina	Flour.
Feb. dur.	Febre durante	During the fever.
Ferv.	Fervens	Boiling.
F. (Ft.) cataplasma	Fiat cataplasma	Make a poultice.
Ft. cerat.	Fiat ceratum	Make a cerate.
Ft. chart. 12	Fiant chartulæ duodecim	Make 12 powders.
Ft. collyr.	Fiat collyrium	Make an eye wash.
Ft. confec.	Fiat confectio	Make a confection.
Ft. elect.	Fiat electuarium	Make an electuary.
Ft. emp. 3 x 6	Fiat emplastrum 3 x 6	Make a plaster, 3 x 6 inches.
Ft. emuls.	Fiat emulsio	Make an emulsion.
Ft. garg.	Fiat gargarisma	Make a gargle.
Ft. h. (haust.)	Fiat haustus	Make a draught.
Ft. infus.	Fiat infusum	Make an infusion.
Ft. inject.	Fiat injectio	Make an injection.
Ft. m. (mist.)	Fiat mistura	Make a mixture.
Ft. pil.	Fiat pilula	Make a pill.
F. L. A.	Fiat lege artis	Make by rules of art.
Ft. linim.	Fiat linimentum	Make a liniment.
Ft. (mas.) massa	Fiat massa	Make a mass.
Ft. mas. div. in pil. 12	Fiat massa in pilulas duodecim dividenda	Make 12 pills.
Ft. pulv.	Fiat pulvis	Make a powder.
Ft. pulv. et div. in chart. 12		Make 12 powders.
Ft. solut.	Fiat solutio	Make a solution.
Ft. suppos. 4	Fiant suppositoria quatuor	Make 4 suppositories.
Ft. troch. 12	Fiat trochisci duodecim	Make 12 lozenges.

Ft. ung.	Fiat unguentum	Make an ointment.
Filtra.	Filtram	Filter (thou), a filter.
Fl., Fld.	Fluidus	Liquid.
Form.	Formula	A prescription.
Garg.	Gargarisma	A gargle.
Gr.	Granum, Grana	Grain, grains.
Grat.	Gratus	Pleasant.
Gtt.	Gutta, guttæ	A drop, drops.
Guttat.	Guttatim	By drops.
Habt.	Habeat	Let him have.
Haust.	Haustus	A draught.
H.	Hora	An hour.
H. s. (hor. som.)	Hora somni	Before going to sleep.
H. d.	Hora decubitus	Hour of retiring.
Hor. interm.	Horis intermediis	At intermediate hours.
Ind.	In dies (indies)	Daily.
Inf.	Infunde	Pour in.
Infus.	Infusum	An infusion.
Injec.	Injectio	An injection.
Int.	Internus	Inner, internal.
Jent.	Jentaculum	Breakfast.
Jux.	Juxta (juxtim)	Near to.
Kali ppt.	Kali præparatum	Prepared kali = $K_2CO_3$ .
Lac.	Lactis	Milk.
Lat. dol.	Lateri dolenti	To the painful side.
Lin.	Linimentum	A liniment.
Liq.	Liquor	A solution.
Lot.	Lotio	A lotion.
Mac.	Macerata	Macerate.
Mag.	Magnus	Large.
M., man.	Manipulus	A handful.
Manus	Manus	The hand.
Mas., mass	Massa (pilularis)	A mass—a pill mass.
Mensur., mens.	Mensura	By measure.
Mic. pan.	Mica panis	Crumb of bread.
M., min.	Minimum	A minim.
Minut.	Minutum	A minute.
M.	Misce	Mix.
Mist.	Mistura	A mixture.
Mitte.	Mittatur	Send, let it be sent.
Mit. tal.	Mitte talis	Send of such like.
Mod. præsc.	Modo præscripto	In manner prescribed.
More dict.	More dictu	In manner directed.
Non	Non	Not.
Non repetat.	Non repetatur	Let it not be repeated.
No.	Numerus (numero)	Number.
N. a.		Numerical aperture.
N. F.		National Formulary.
O.	Octarius	A pint.
Omn. hor.	Omni hora	Every hour.
O. m.	Omni mane	Every morning.
Omn. bih.	Omni bihora	Every two hours.
O. n.	Omni nocti	Every night.
P. æ.	Partes æquales	Equal parts.
Part. vic.	Partitis vicibus	In divided doses.
P., pt.	Perstetur	Continue.
Penicil. cam.	Penicillum camelinum	Camel's hair pencil.
Pas., pastil.	Pastillum, pastillus	A small lozenge.
P. P. A.	Phiala prius agitata	First shaking the bottle.
Pil.	Pilula	A pill.
Pocul., pocill., poc.	Poculum, pocillum	A cup, a little cup.
P.	Pondere	By weight.
Pone aur.	Pone aurem	Behind the ear.
Pot.	Potus	Drink.
Præp.	Præparat(us)-a	Prepared.
Prand.	Prandium	Dinner.

Prim. man. . . . .	Primo mane . . . . .	Early in the morning.
Pro rat. æt. . . . .	Pro ratione ætatis . . . . .	According to the age of the patient.
P. r. n. . . . .	Pro re nata . . . . .	When necessary.
Pug. . . . .	Pugillus . . . . .	A pinch.
Pulv. . . . .	Pulvis, pulverizatus . . . . .	A powder, powdered.
Pyx. . . . .	Pyxis . . . . .	A pill box.
Q. l. . . . .	Quantum libet . . . . .	As much as is required.
Q. p. . . . .	Quantum placet . . . . .	As much as is required.
Q. v. . . . .	Quantum vis, volueris . . . . .	As much as is required.
Q. s. . . . .	Quantum sufficit . . . . .	A sufficient quantity.
Qq. hor. . . . .	Quaqua hora . . . . .	Each, every hour.
Q. q. . . . .	Quoque, quaque . . . . .	Also—each, every.
Rec. . . . .	Recens . . . . .	Fresh.
R. . . . .	Recipe . . . . .	Take.
Rept. . . . .	Repetatur . . . . .	Let it be repeated.
Scat. . . . .	Scatula . . . . .	A box.
S. a. . . . .	Secundum artem . . . . .	According to art.
S. n. . . . .	Secundum naturam . . . . .	According to nature.
Ss. . . . .	Semis . . . . .	A half.
Semih. . . . .	Semihora . . . . .	Half an hour.
Sesqh. . . . .	Sesquihora . . . . .	A hour and a half.
Sig. . . . .	Signa . . . . .	Mark thou, sign.
Sing. . . . .	Singulorum . . . . .	Of each.
Si n. val. . . . .	Si non valeat . . . . .	If it does not answer.
Si op. sit. . . . .	Si opus sit . . . . .	If necessary.
Solv. . . . .	Solve, solvetur . . . . .	Dissolve.
Stat. . . . .	Statim . . . . .	Immediately.
St. . . . .	Stet, stent . . . . .	Let it stand.
S. s. s. . . . .	Stratum superstratum . . . . .	Layer upon layer.
Sum. . . . .	Sume, sumat sumendus . . . . .	Take, let it be taken.
Summit. . . . .	Summitates . . . . .	The summits, tops.
Sup. . . . .	Super, supra . . . . .	Above.
Tal. . . . .	Talis . . . . .	Such, like this.
T. i. d. or t. d. . . . .	Ter (in) die . . . . .	Three times a day.
Tinct., tr. . . . .	Tinctura . . . . .	Tincture.
Trit. . . . .	Tritura . . . . .	Triturate.
Troch. . . . .	Trochisci . . . . .	Lozenges.
Ter. . . . .	Tere . . . . .	Rub.
Ter. bene . . . . .	Tere bene . . . . .	Rub well.
Ult. præsc. . . . .	Ultimo præscriptus . . . . .	The last ordered.
Una . . . . .	Una . . . . .	Together.
Unc. . . . .	Uncia . . . . .	An ounce.
Utend. . . . .	Utendum . . . . .	To be used.
Ut Dict. . . . .	Ut dictum . . . . .	As directed.
U. S. P. . . . .	U. S. P. . . . .	United States Pharmacopœia.
Vehic. . . . .	Vehiculum . . . . .	A vehicle.
Vel . . . . .	Vel . . . . .	Or.
Vesp. . . . .	Vesper, vesp̄eris . . . . .	The evening.
Vom. urg. . . . .	Vomitiōne urgente . . . . .	The vomiting being troublesome.

SOME LEADING OFFICIAL ORGANIC DRUGS WHOSE MEDICINAL PROPERTIES  
DEPEND UPON ONE OR MORE SPECIFIC CONSTITUENTS.

1. *Sugar.*

Fig, Honey, Manna, Prune, Triticum.

2. *Sugar + Acid.*

Cassia Fistula, Lemon Juice, Phytolacca  
Fruit, Raspberry, Tamarind, Rhus Glabra.

3. *Mucilage.*

Althæa, Cetraria, Chondrus, Elm, Sas-  
saparilla, Pith, Acacia, Tragacanth.

4. *Volatile Oil.*

Anise (1-3 p. c.), Buchu (1-1.6 p. c.),  
Calamus (1-3.5 p. c.), Caraway (5-7 p. c.),  
Cardamom (5 p. c.), Cascarilla (1.6 p. c.),  
Chenopodium (3-3½ p. c.), Cinnamon (½-  
2 p. c.), Cloves (18 p. c.), Coriander (½-  
1 p. c.), Cubeb (5-15 p. c.), Eriodictyon,  
Eucalyptus (6 p. c.), Fennel (2-6 p. c.),  
Garlic (¼ p. c.), Ginger (1-3 p. c.), Hedeo-  
ma (1 p. c.), Illicium (2-5 p. c.), Lemon  
Peel (2 p. c.), Mace (8 p. c.), Marrubium,



Melissa ( $\frac{1}{2}$  p. c.), Mustard, Nutmeg (2-8 p. c.), Orange Peel (Bitter), Orange Peel (Sweet), Pepper (1-2 p. c.), Peppermint (1 p. c.), Pimenta (3-4 p. c.), Rose Pale, Rose Red (.05 p. c.), Saffron (1 p. c.), Salvia ( $\frac{1}{2}$ -2 p. c.), Sambucus, Sassafras (6-9 p. c.), Scutellaria, Spearmint ( $\frac{1}{2}$  p. c.), Sumbul ( $\frac{1}{2}$ -1 p. c.), Tansy ( $\frac{1}{2}$  p. c.), Valerian, Vanilla ( $\frac{1}{2}$ -2 p. c.).

#### 5. Concrete Volatile Oil.

Camphor, Menthol, Thymol.

#### 6. Resin.

Guaiac, Mastic, Rosin, Aspidium, Cascara Sagrada, Caulophyllum, Cimicifuga, Cottonroot Bark, Frangula, Jalap, Kamala, Podophyllum, Pulsatilla, Pumpkin Seed, Stillingia.

#### 7. Oleoresin.

Copaiba (oil, 20-90 p. c.), Turpentine (oil, 20-30 p. c.), Turpentine Canada (oil, 24 p. c.), Burgundy, Pitch, Tar.

#### 8. Gumresin.

Gamboge (gum, 16-25 p. c., resin, 66-80 p. c.), Scammony (gum, 3-8 p. c., resin, 75-90 p. c.), India Rubber (resin, 32 p. c.).

#### 9. Gum, Resin, + Volatile Oil.

Ammoniac (gum, 18-28 p. c., resin, 70 p. c., vol. oil, 1-4 p. c.), Asafetida (gum, 20-30 p. c., resin, 60-70 p. c., vol. oil, 6-9 p. c.), Myrrh (gum, 40-60 p. c., resin, 25-40 p. c., vol. oil, 4-8 p. c.).

#### 10. Balsam.

Benzoin (benzoic acid, 10-20 p. c.), Balsam of Peru (resin, 16-25 p. c., cinnamon, 56-66 p. c.), Balsam of Tolu (vol. oil, 1 p. c.), Storax.

#### 11. Volatile Oil (Resin) + Bitter Principle.

Absinthium, Arnica, Asclepias, Chamomile, Cypripedium, Grindelia, Hamamelis, Inula, Iris, Lappa, Lupulin, Matico, Matricaria, Mezereum, Phytolacca Root, Pyrethrum, Serpentaria, Xanthoxylum, Cusso, Indian Cannabis.

#### 12. Fixed Oil +.

Aspidium, Cottonroot Bark, Flaxseed, Lycopodium, Pumpkin Seed, Pyrethrum, Stillingia, Sweet Almond, Vanilla.

#### 13. Tannic or Gallic Acid.

Castanea, Catechu, Gambir, Geranium, Hamatoxylon, Kino, Krameria, Nutgall, White Oak, Wild Cherry, Rubus, Rumex.

#### 14. Glucoside.

Aloes, Apocynum, Araroba, Bryonia, Calendula, Calumba, Dulcamara, Capsicum, Chimaphila, Chirata, Colocynth, Convallaria, Corn Silk, Digitalis, Ergot, Euonymus, Eupatorium, Glycyrrhiza, Juglans, Leptandra, Quillaja, Rhubarb, Rhus Toxicodendron, Santonica, Sarsaparilla, Senega, Senna, Squill, Strophanthus, Taraxacum, Uva-Ursi, Vanilla, Viburnum, Cascarilla, Wild Cherry, Cetraria, Caulophyllum, Cloves, Cubeb, Frangula, Guarana, Kamala, Quassia, Phytolacca.

#### 15. Alkaloid.

Aconite, Aspidosperma, Belladonna, Chelidonium, Cinchona, Colchicum, Conium, Coca, Calumba, Gelsemium, Guarana, Hydrastis, Hops, Hyoscyamus, Ipecac, Lobelia, Menispermum, Nux Vomica, Opium, Pareira, Pepper, Physostigma, Pilocarpus, Pomegranate, Sanguinaria, Scoparius, Spigelia, Staphisagria, Stramonium, Tobacco, Veratrum.

#### THE PRONUNCIATION OF SOME IMPORTANT WORDS USED IN THIS WORK.

Ab-i-et'ic.  
Ab'i-e-tin.  
Ab'rin.  
Ac-et-an'i-lide—(As).  
Ach-il-le'ine.  
Ad-on'id-in.  
A-gar'i-cin.  
Ag'a-thin.  
A-lan'tol.  
A-liz'a-rin (Al-i-za'rin).  
A-myg'da-lin.  
An-drom-e-do-tox'in.  
An-e-mon'ic.  
A-nem-o-nin'ic.  
An'e-thol.  
An-them'ene.  
An-them'ic.

An-them'i-din.  
An-them'ol.  
An-thra-ro'bin.  
A'pi-in.  
Ap'i-ol.  
Ap-o-at'ro-pine.  
A-poc-y-ne'in  
(A-po-cyn'e-in).  
A-poc'y-nin—(pos').  
Ap-o-ret'in.  
Ar'a-chin.  
Ar'bu-tin.  
Ar'is-tol.  
Ar-tem'i-sin.  
As'a-prol.  
As-cle-pi'a-din  
(As-cle-pi-a'din).

A-sel'line.  
A-sep'tol.  
As-pid-os'a-mine.  
As-pid-o-sper'ma-time.  
As-pid-o-sper'mine.  
A-tro-pa'mine.  
A-tro-pur-pu'rin.  
At'ro-sin.  
Bal-sam-i'to.  
Bas'so-rin.  
Bdel'li-um—(Del').  
Benz-al'co-hol.  
Ben-zan'i-lide.  
Ber-ga'mi-ol.  
Ber-gap'tene.  
Be'ta-ine.

PRONUNCIATION OF SOME WORDS USED IN THIS WORK. 941

Be'tol.	Co-nyd'rine (Co-ny'drine).	Gal-lac-e-to-phe'none—
Bil-i-neu'rine.	Cor-dil-le'ra—(la').	Gal-lan'i-lide. [(las).
Bil-i-ru'bin.	Cre'o-lin.	Ge'lose.
Bor'ne-al.	Cres'al-ol.	Gel-se'mic.
Bry-oi'din.	Cre'sol.	Gel-se-min'ic.
	Cro'ce-tin.	Gel-se'mi-nine.
	Cu'pre-ine.	Gen-ti-an'ic.
		Gen'ti-an-in.
Caf-fe'id-ine.	Daph'ne-tin.	Gen'ti-an-ose.
Caj'e-pu-tol.	Der'ma-tol.	Gen-ti-o-pic'rin.
Cal-a-bar'ine.	Di-ap'the-rin.	Gen-tis'ic.
Caout'chouc (Koo'chook).	Dig-i-tal-et'in.	Glu'cin.
Cap-ron'ic.	Dig'i-tal-in.	Gly-co-chol'ic.
Ca-pryl'ic.	Dig-i-tal-os'min.	Gly'co-coll.
Cap-sa'i-cin.	Dig-i-to-flav'on.	Glyc-yr-ram'a-rin.
Cap'si-cine.	Dig-i-to-le'ic.	Glyc-yr-rhet'in.
Ca-ra'cas.	Dig-it'o-nin.	Glyc-yr-rhi'zic.
Car-min'ic.	Dig-i-to-ph'yl-lin.	Glyc-yr-rhi'zin—(Glys)
Car-nau'bic.	Dig-i-tox'in.	(Gly-cyr'rhi-zin).
Car-ra-gee'nin.	Di-pen'tene.	Guai-ac'ic—(as').
Car'ra-gen.	Di-u-re'tin.	Guai'a-cin—(Gwi').
Car'tha-mine.	Du-boi'sine.	Guai-a-con'ic.
Car-y-o-phyl'lene.	Dul-ca-ma'rhe-tin	Guai-a-ret'ic.
Car-y-o-phyl'lin.	(Dul-ca-ma-rhet'in).	Gur-ju'nic.
Ceph-a-e'line.	Dul-ca-ma'rin.	
Ce-rot'ic.		Ha-ma-te'in.
Ceryl'ic.	E-lat'e-rid.	Hel-le-bore'in.
Ce-trar'ic.	El'e-mi.	Hel-le-bo-res'in.
Ce-tra'rin (Cet'ra-rin).	El-em'ic.	Hel-le-bor-et'in.
Cetyl'ic.	El-e-op'ten.	Hes-per'e-tin.
Cev-a-dil'lic.	El-lag'ic.	Hes-per'i-din.
Cev'a-dine.	Em'e-tine.	Ho-mat'ro-pine.
Chav'i-cin.	Em'o-din.	Ho-mo-quin'ine
Chav'i-col.	Er-go-chry'sin.	(Ho-mo-qui-nine').
Chel-e-ryth'rine.	Er-go-ti'na.	Hy-drac'e-tin—(dras').
Chel-id'o-nine.	Er-go-tine.	Hy-dro-e-lat'e-rin.
Chel-i-do-xan'thine.	Er-go-tin'ic.	Hy-dro-quin'ine.
Chi-maph'i-lin.	Er-got'i-nine.	Hy-dro-qui'none.
Chi-noid'ine.	Eric'o-lin.	Hy-drox-yl'am-ine.
Chi-rat'in.	Er-i-o-dic-ty-on'ic.	Hy-os'cine.
Cho-lal'ic.	Eryth-ro-cen-tau'rin	Hy-os-cy'a-mine.
Chole-pyr'rhin.	(Ery-thro-cen-tau'rin).	Hy-os-cy-pic'rin.
Cho-les'ter.	E-ryth-ro-phlœ'ine	Hy'o-sin.
Chol'ic.	(Ery-thro-phlœ'ine).	
Chlo'ral-ose.	Eryth-ro-re'tin	Ich'thy-ol.
Chry-sat'ro-pic.	(Ery-thro-re'tin).	In-fla'tin.
(Chrys-a-trop'ic).	E-er'a-mine.	I'o-dol.
Chrys'o-phan.	E-er'i-dine.	
Chrys'o-phan'ic.	Eth'yl-ene.	Je-co'le-ic.
Cin-chon'i-cine.	E-thyl'i-dene.	Ju'ni-per-in.
Cin-chon-i-di'na.	Eu'ge-nol.	
Cin-chon'i-dine.	Eu'pho-rin.	Lac-to-phen'in.
Cin-cho-ni'na.	Eu'ro-phen.	Lec'i-thin—(Les').
Cin'cho-nine—(Sin').	Ex-al'gin.	Li-chen'ic.
Cit'rine.		Li'chen-in.
Cit-ron-el'lal.	Fab-i-an'ine.	Li-mo'nene.
Col-chic'e-in.	Fe-lic'ic—(lis').	Lo-be-lac'rin.
Col-chi-co-res'in.	Fer-u-la'ic.	Lo-be'lic.
Col-o-cyn-the'in.	Fer'u-lic.	Lo'be-line.
Col-o-cyn'the-tin.	Fer'u-lyl.	Lo'so-phan.
Con-cus'co-nine.	Fil'i-cin.	
Con'i-ce-ine.	Fil-i-cin'ic.	Man-del'ic.
Co-ni'ic.	For-mal'de-hyde.	Man'ni-tan.
Con-val-la-ma're-tin.	For'ma-mide.	Mar-ru'bi-in.
Con-val-la-ma'rin	For-man'i-lid.	Mas-tic'ic—(tis').
(Con-val-lam'a-rin).	Fran-gu-lin'ic.	Mas'ti-cin.
Con-val-la-re'tin.		
Con-val'la-rin.		

Mel'i-tose.	Pseu-dac'o-nine.	Sclero-tin'ic.
Me-liz'i-tose.	Pseu-dac-on'i-tine.	Scler-ox-an'thin.
Men'thene.	Pseu-dac'o-rus.	Sco-po'la-mine.
Men'thol.	Pseu-dat'ro-pine.	Scroph'u-la-rin.
Men-y-an'thin.	Pay-chot'rine.	Scu-tel'la-rin.
Met-a-co-pai'vic.	Pur'pu-rin.	Sen'nac-rol.
Meth-ac'e-tin—(as').	Pyr-o-guai'a-cin.	Sen-na-pic'rin.
Meth'yl-al.		Ses'a-min.
Meth'yl-co-ni-ine.	Que-bra'chine.	Sin-al'bin.
Meth'yl-ene.	Quer'ce-tin.	Sin'a-pene.
Me-thys'ti-cin.	Quer'cit-rin.	Sin'a-pic.
Mor'rhu-ine.	Quin-am'i-a.	Sin'i-grin.
Mor'rhu-ol.	Quin-am'i-cine.	So-lan'i-dine.
Mus'ca-rine (Mus-car'ine).	Quin-a-mi'na.	Sol'a-nine.
Myr'o-sin.	Quin'ic.	So'zal.
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Myr-rhe'nol.	Qui-ni-di'na.	So-zo-i-o-dol'ic.
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	Qui-ni'na.	Ste-a-rop'ten.
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Ni-co'ti-an-in—(ko'shi).	(Qui'nine)—(Kwi').	Stro-phan'thi-din.
Nic'o-tine.	Qui-no'vic.	Styr'a-cin.
	Qui-no'vin.	Sty'ro-lene.
Pal'len-in.	Res-or'cinol.	Sulph-am'i-nol.
Pa-naq'ui-lon—(nak'wi).	Rham'ne-tin.	Sul'pho-nal.
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Par-ar'ab-in.	Ri'cin.	Tau-ro-chol'ic.
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